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December 24, 1925

Engineering News-Record

RAILWAY CONSTRUCTION CAMP IN QUEBEC

Facts in the Texas Highway Controversy

Reconstruction of a Paper Mill in the State of Washington

Concrete Street Paving in Chicago

Principles of Soil Mechanics: Friction in Sand and Clay

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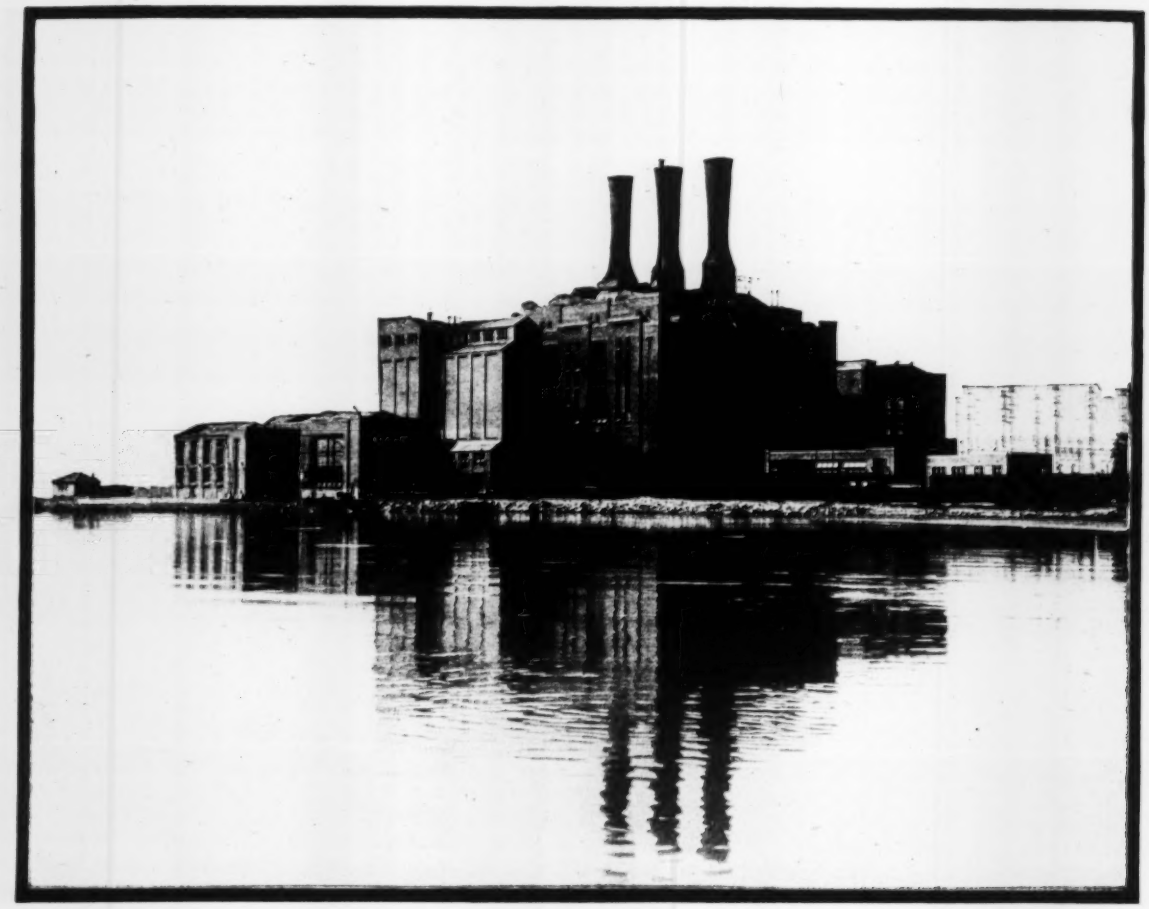

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FRANK C. WIGHT
Editor

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Get Distribution Data

AT THE National Distribution Conference held in Washington last week one thing was evident—that little progress can be made in reducing the spread between producer cost and consumer price until there are available more complete statistics of distribution. After a number of years of desultory census figures we are now just beginning to get some real basic data on production. It has been a long pull, overcoming first the manufacturer's reluctance to divulge his own figures and last the government's suspicion as to the legality of group collection of data, but the facts as to production are beginning to come out. Such figures are not for the amateur, but rightly understood by the expert they unquestionably are important among the factors which are reducing production costs. Distribution costs, on the other hand, remain high. Scientific marketing is possible but before a slow general campaign toward such improved methods can be started we must know what are the facts about distribution. The conference at Washington pointed this out and doubtless will serve as the initiatory move toward more intelligent collection of distribution statistics. If the conference did only that it will have been worth while.

Auto-Accident Credit

ABILITY to pay damages as a condition of holding a certificate of motor vehicle registration will be required in Connecticut. On Jan. 1, 1926, the so-called "financial responsibility" law enacted by the General Assembly last winter will go into effect. In brief it provides that when the State Commissioner of Motor Vehicles deems such action warranted he can demand from a registrant certificate of ability to pay damages up to $10,000 for life and to $1,000 for property. Demand for a certificate of responsibility is warranted on conviction of an injury to person or damage exceeding $100 to property resulting from reckless driving, including speeding, driving when drunk and evasion of responsibility. Qualifications of responsibility may be insurance, surety bond or a cash or collateral deposit. Passing by any questions of the fairness and hardships of such a law it is important to point out to highway officials the prime requisite for its just enforcement. This requisite is a statistical record of motor vehicle accidents. Connecticut possesses such a record and keeps it with a precision equaled in few states. On the card of every motor vehicle registrant there is charged against him every conviction of accident. The Commissioner of Motor Vehicles has thus the evidence by which to determine when he may rightly require the qualifications specified in the law. It is a prerequisite for the drafting of any just law for safe operation of motor vehicles, and for the just execution of the law, that accurate accident records are had. Not many states have them.

A Sign of Progress

A FEW short years ago a conference on planned land settlement such as was held in Washington last week would not have been possible. The basic idea was at that time strange, and to most men seemed chimerical in its aims and paternalistic (not to say communistic) in its methods. Yet at last week's gathering, where the most diverse interests were represented and where the speakers disagreed sharply on all phases of agriculture, reclamation, and development policy, planned settlement was endorsed almost unanimously and with obvious conviction, as the necessary foundation of successful land development. This is a surprising and gratifying change. It indicates that ideas are evolving, through study of facts. Back of the change is a wide dissemination of knowledge concerning experiences in irrigation-project development. Many people have come to realize that delayed or warped development has converted promising projects into losing enterprises. These experiences made little impression heretofore, even in the circles immediately affected, and their significance was masked by various complicating factors. The sensational happenings in the federal reclamation service during the last three years brought the subject into the spotlight, and the result is that there is clearer thinking on reclamation economics today. The dollars-and-cents criterion is recognized as no less applicable to a public irrigation development than to a private industrial enterprise, and the conclusion is reached that in either case the completed enterprise must be put into production promptly if it is not to be stifled by accumulated fixed charges. The dollars-and-cents view has been accepted not only by ordinary citizens, but also by members of Congress. This is especially fortunate. It can hardly fail to raise the level of our public-works legislation.

Highway Research

A CENSUS of major highway research activities in the United States has been made by the Highway Research Board and is published by the Bureau of Public Roads. It deserves very careful attention. Some ninety separate investigations are being made in economics, operation, design, design of vehicles, and construction. A number of these studies also have two or more distinct phases which involve virtually separate investigations so that it may fairly be said that over a hundred major tasks in highway research are being carried out by public roads departments, technical schools and engineering and industrial organizations. Numerically this is an excellent record. The greater significance is, however, in the character of the investigations. None of them are routine tests or the incidental developments of general truths from routine tests. They are definite undertakings in research study. Most of them relate to details of materials, methods and equipment used in construction but others, a considerable number, are directed

toward the determination of broad truths of experience and the fundamental principles of highway design and operation. Not the least important fact to be noted is the cognizance being taken, in a round half-dozen studies being made of the design of vehicles, of the important relation which exists between the vehicle and the road —their reactions upon each other. Outstanding here and in a score of other studies is the growing realization of road engineers that highway development is as fully a problem of operation as it is a problem of construction.

Texas Road Scandals

REVERSION to conditions of public roads administration which were common a generation ago has taken place in Texas. Then roadbuilding was commonly a political activity. It is rarely so now. The facts of the Texas road situation are plainly stated in the article in this issue. In the main items at least they admit of no misinterpretation and present no claims for extenuation. They show in the instances cited the degeneration of state road management from a highly special business of engineering administration to a political deal. This is a sorry condition to have come out of a war against bigotry in politics and out of a victory which elated a nation. It is doubly an evil thing because it gives excuse for questioning the probity of state road management everywhere. It is a weak rebuttal to assert that in general state management is of notably high character and is constantly being improved as the public gains knowledge of the intricate engineering problem of highways and modern motor traffic and is placing engineers in technical control. Yet the assertion in justice must be made. There is today no service of government exceeding in honesty and efficiency the work of the Federal Bureau of Public Roads and the highway departments of the several states. The occurrence in Texas is a throw back to primitive ancestry—partisan political public roads administration.

Building Accidents Continue

MUCH arduous labor has been devoted to improving municipal building inspection in recent years. Yet building accidents continue to occur with monotonous regularity. The revision of building laws and agitation for improved building supervision in which most of our cities have engaged during the past five or six years does not seem to have brought about any obvious decrease in careless building—if anything, the opposite. In recent weeks the common type of accident has been failure of an old building due to alteration operations or due to disturbance by construction work on the adjoining plot; several such accidents were contributed by New York City alone. At other times accidents involving inadequately braced framework, poorly laid masonry or rough-and-ready concrete are more frequent. But whatever the kind of accident, the subsequent investigations and prosecutions uniformly lead to no results. They show in all instances, however, that dependence on municipal supervision to make the work safe is illusory, and that the actual elements of safety or unsafety lie in those who plan and direct the work.

It ought to be easy to turn this conclusion to good account. When anyone is entitled to take out a building permit, anyone is authorized to build under the permit, and any one may direct the work—or no one at all—accidents are to be expected whenever a few unfavorable conditions happen to come together. The record of building accidents confirms the expectation. A simple way out is to require that building shall be done under competent planning and direction. But there is difficulty in obtaining support for such a requirement. Architects and engineers who have been active for several years to put it into effect have so far failed to get results. The safety of building continues to depend on hurried scrutiny of plans and occasional visits to the work by the building inspector, and the public appears to be satisfied with the plan of putting the burden of responsibility on municipal authorities. Apparently the public's attitude is largely shared by engineers and architects, especially those who are more concerned with business questions and professional prerogatives than with public safety. Yet public and professional men alike feel shocked when a building collapses, and still more so when it is later shown that there were no competent men in charge of the job or that responsibility was divided and confused.

The engineering profession, which has equipped itself with highly organized professional machinery for public service, should be able to better the state of affairs described. The necessary prerequisite, however, is that the evils of the situation be fully appreciated by engineers.

Take Traffic Control From Police

LAST year Congress provided the city of Washington with a new official—a traffic director. Theoretically, and in the minds of most of those who heard about the move, he was to be just what the title implies, a sort of minor czar in this new and overwhelming municipal evil, subject only to the approval of the Commissioners of the District in the larger matters of policy. The experiment was looked upon favorably, as a trial in the capital city of a system which if successful could be introduced in our other cities where changes in government administration are somewhat more difficult to make. After a year they are now taking stock in Washington and they find that the innovation, while hopeful, cannot be really called successful unless the office of traffic director be completely divorced from the police department. This is so important a conclusion that all those interested in traffic control should take note of it.

The Washington traffic director is an engineer, as is his executive assistant. These men have applied engineering thought and engineering methods to the administration of the traffic rules of the city. The residents are not altogether satisfied, which is to be expected, because every pedestrian and every motorist considers himself a traffic expert and no rules devised will ever satisfy any one man and because, too, each one has some pet obsession or selfish desire which any set of rules designed to benefit a whole community is bound to violate. Nevertheless, the visitor to Washington, unburdened by the traffic customs which once prevailed there and free from personal desires as to parking or routing, finds there now as comfortable a traffic condition, both for pedestrian and motorist, as is possible in these motor-made days, and certainly a condition far superior to that of our average city.

So much for what Director Eldridge has done, but his lot is far from happy, because of the law which still makes him dependent upon the police for the execution of his plans. He may order, for instance, a certain traffic sign for a certain corner, and that order must go through the routine of the police department to emerge a week or so later as an altogether different sign on an altogether different corner. He may have a special rule which he wishes enforced, but for the patrolmen to enforce the rule he is dependent upon the desire and will of the police. He has at his immediate command ten policemen, under assignment; the traffic squad of some seventy or eighty are not responsible to him or subject to his orders.

In other words the new law goes only part of the way toward a rational solution of traffic control. It is not necessary to criticize the police department of Washington to say that as things are now the law is far from perfect. So far as information goes, there is no conflict between Mr. Eldridge and the police. They may be in perfect sympathy. But a police department is a complex thing, subject to many inner promptings and outward influences, and one of the things that it is not congenitally fitted for is co-operation.

One important step forward was made in Washington in providing a traffic director of technical background instead of the usual police sergeant or lieutenant, whose desires for rational thinking on traffic are more often than not overwhelmed by the traditions of his trade, but the experiment will not be complete until amendment is provided whereby the director has his own traffic squad in sufficient number and of sufficient power to supervise traffic everywhere and enforce rules that are made. Sooner or later the cities are all coming to realize that traffic control is not a policemen's job. Washington has started out to prove this. Let Congress, the city council of the District of Columbia, carry out its intentions of reform to their legitimate end and establish a traffic department that can both plan and execute.

Gambling in Buildings

SOME commotion was caused in New York building circles last week by a meeting at which representatives of certain money lending interests sensationally denounced the "overbuilding" of New York, and predicted a building crisis which would be the "worst in forty years." New York newspapers gave so much space to the agitation, and to a much press-agented committee appointed later, that garbled reports will probably go out over the country and cause unwarranted concern over the general state of building, whereas the condition under attack is extremely localized.

New York City building has been experiencing a tremendous boom in two localities and types of structure, the loft and mercantile type in the middle west side—that is between 23rd and 42nd St. west of Broadway, the district a year or so ago given over to garment manufacturing—and in apartment building in the outlying areas of the Bronx and Queens. Starting out with normal building improvement both of these sections and types ran wild. For some time the development has been far beyond a sane investment basis and has been in the hands of gamblers whose money has come easy and whose estimates of future profits are made not on prospective use of the property but upon the success of the early operators in selling to other gamblers who hoped to be at least the next to last owner of the property before the boom burst. Meanwhile the prospective occupants of the lofts and apartments have been growing less and less. As in all real estate movements there was the early rush to get into a new trade or apartment center, and the first of the new structures were soon filled. This led the speculative element on to new ventures, secure in the gambler's assurance that what has happened will continue to happen and regardless of any scientific analysis of the real demand for new building.

Accompanying this movement has been a deplorable lack of technical expertness in building. Most of the structures have been laid out by incompetent architects, designed by engineers just to get by the building department and built by subcontractors under the direction of a superintendent who as often as not was merely a foreman elevated by name only to responsibility. Permanence will probably be the least evident of the qualities of structures so built. And this is the more deplorable because in many instances the buildings have been financed by bond houses of doubtful reliability and the bonds bought by a gullible public. When the obvious glut in the market for such buildings comes these bondholders are going to suffer.

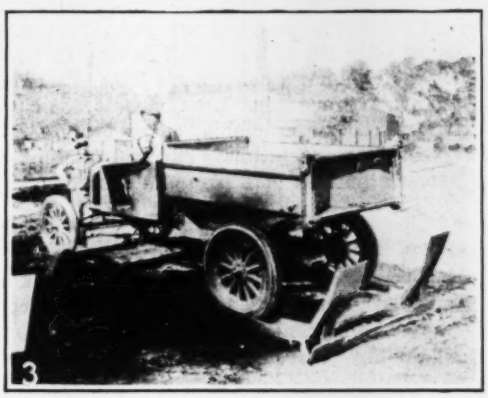
But it is doubtful if this craze of speculation is going to damage any but those who have participated in it. The financial interests who were most vocal in the recent meeting evidently feel that the time has come to put the brakes on this kind of speculation. Undoubtedly they are right; if anything can be done to stop the gambler from playing in real estate and bricks and steel and mortar that thing should be done. But these speculations, after all, are in isolated sections of New York and except by possible future infection, do not affect the real building situation there. The acres of steel frames that have been visible west of middle Broadway for a year or more have been impressive. They have made casual visitors believe that New York was engaged in a mad orgy of construction. This was not a fact. The orgy was the indulgence of certain gamblers and it looks now as though their game was about through. They will have to look for more speculative worlds to conquer, possibly in the fields of pure real estate development, for which they have so enchanting an example in Florida.

Some of these gamblers are going to lose money but unfortunately most of them are going to get out whole and pass on such losses as there are to the speculative financiers who backed them and the credulous investors who accepted the financiers' assurances of profit. The city is injured by the excessive congestion brought about by this massing of workshops in a downtown section. There is little, indeed, in the whole operation to commend and much to condemn, but again it should be noted that it is only a small part of the grand total of building in the New York district. It bears every earmark now of slowing down under its own defects, so that in itself it can do little more harm to business or building stability. The danger is that what has happened will be misunderstood and the purely speculative nature of the operations attacked will not be sufficiently broadcast.

Concrete Street Paving in Chicago

Two-Course Concrete with Center Joint and Plenty of Joints for Expansion—Finishing and Curing Present Several Novelties in Methods and Tools

CONCRETE paving has been widely extended in Chicago during the last two years. It is being used on both wide heavy-traffic streets and residence streets. For alley paving it is the standard. In this comparatively new development several features of practice attract attention. The most striking is that generally two courses of different mixtures are being used —a practice which is comparatively rare in recent years. On standard width streets a center joint is used, wider streets are paved in strips and there is a high development of expansion joints on all pavements. It is on materials and workmanship, however, that stress is laid and particularly on perfection and methods of surface finish. This article reviews some of the more outstanding of these features of structure and construction of concrete pavements.



FIGS. 1-3—DETAILS OF CONCRETE PAVING WORK, CHICAGO
Fig. 1—Loading stone from street stockpile. Fig. 2—Trailer cement stockpile and charging platform. Fig. 3—Turntables protect subgrade from turning trucks.

Features Influencing Design—Besides traffic, which in Chicago as in all large cities is intensive and always increasing, temperature range, topography and ground conditions are important controlling factors in pavement design. Temperature records show a range of 114 deg. F. These are Weather Bureau figures and it is thought that at street level it is fair to presume a range of 140 deg. F. This range has to be considered in design for expansion and contraction. Except for a few parts Chicago is level; drainage of pavements commonly must be secured by alternately elevating and depressing the gutters and thus introducing a repeatedly changing cross-section. Incidentally it multiplies catchbasins beyond the number needed to handle the volume of flow. The ground under the pavements changes from debris from the Chicago fire and sand along the lake to blue clay over most of the city area; foundation preparation has to vary accordingly and normally is a heavy clay soil consolidation problem.

Design Adopted—Influenced by the conditions stated, a pavement design has been worked out whose main idea is the level street intersection—no step from the sidewalk onto the pavement at curb line—and the drainage of the surface water away from the intersection toward the block centers. Thickness and crown vary with width and traffic, but in general practice tend toward increasing thickness and flatter crowns for all pavements. In the matter of detail note may be made of the separation of the street-railway right-of-way pavement zone from the side roadway pavement. In most cases the separation is made by several lines of granite blocks along the boundary lines but sometimes virtually a curb of granite is put in. This construction relates of course only to concrete or asphalt streets. As a variation to be noted, there has recently been built in the new produce market district a considerable length of concave or dished cross-section pavement. It gives certain advantages of direct sewer connections which cut costs and extension of its

use is being considered—this for main streets, not alleys, where a dished section has long been common.

Concrete Pavements—There are three types of concrete-paved streets. The residence street pavement is normally a 6-in. full-width slab with a longitudinal center joint. On wide streets with trolley lines the railway right-of-way is paved (1) with granite blocks or (2) with concrete, and the side strips are concrete. These heavy traffic pavements are 8 to 10 in. thick. Two-course concrete is general except where some streets have been paved by the vibrolithic method.

The mix of the two-course pavement is approximately 1:2:3½ (requiring 6.4 sacks per cubic yard of finished concrete in place) for both layers, using either lime-

FIG. 4—PAVING MIXER OUTFIT ON RESIDENCE STREET

stone screenings or torpedo sand with limestone or gravel in the base. For the wearing course torpedo sand and crushed granite or trap rock is specified. The thickness of the wearing course is 2 or 3 in. and that of the base either 6 or 7 in.—a complete pavement of 8 or 10 in. in depth—depending upon the traffic conditions. The wearing course is laid within 45 minutes of the time that the base is laid.

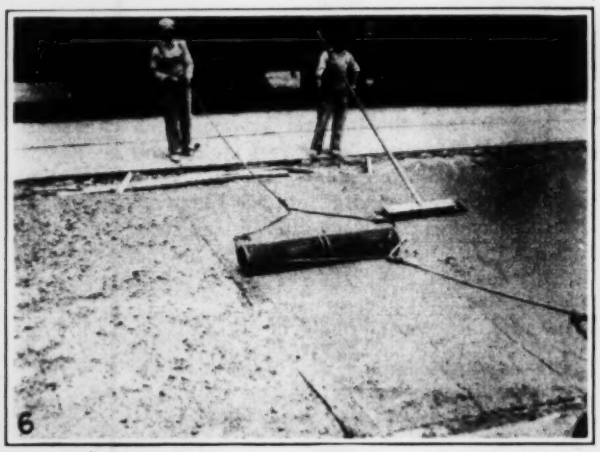
FIG. 5—VIBROLITHIC FINISHING ON ALLEY PAVEMENT

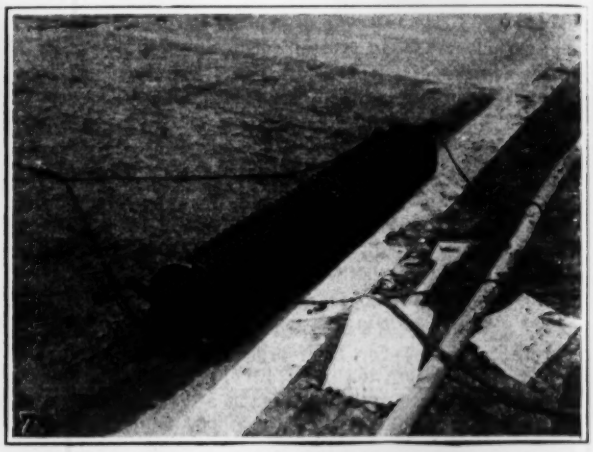
Expansion joints ¾ in. thick are placed across the concrete pavement at all street intersections in conformity with all curb lines produced; provided that at the street intersections, where curb lines produced do not coincide and the interval between such curb lines produced is less than 20 ft., one joint only is placed. Transverse expansion joints are also placed at right angles to the center line of the roadway across the concrete pavement between intersecting streets, at intervals of 30 ft., or as near as may be but not exceeding 31 ft. measured along the center line of the roadway. A preformed joint filler is used.

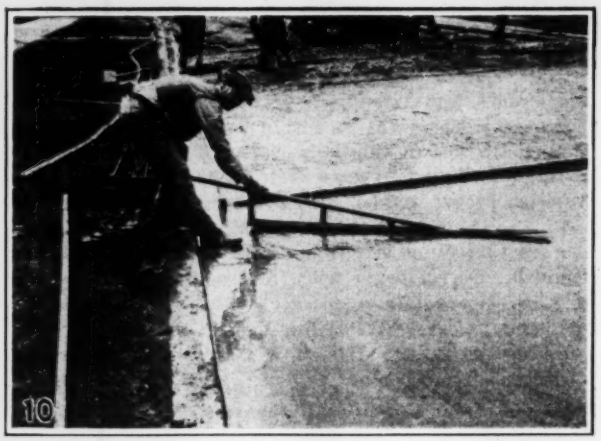
Standard separation plates of No. 18 U. S. metal gage having a corrugation along the center, lapping 2 in. at their joints, and extending vertically from the base of the concrete pavement to within ½ in. of the top of the finished surface of the pavement, are placed along the center line of all roadways 20 to 40 ft. in width, which are without car tracks. On roadways above 40 ft. in width, additional lines of separation plates are used forming strips not less than 10 ft. or more than 20 ft. in width. On roadways with car tracks, 60 ft. in width or over, two joints are placed midway between the curb and tracks. A building paper separation plate, weighing 12 lb. per 100 sq.ft. is placed between the concrete slab and the gutter.

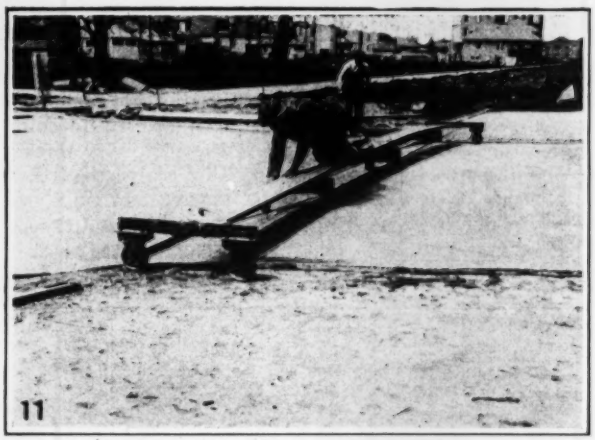
Construction Methods—Except in details, some of which are unusual, the construction outfits and methods are those familiar in concrete road work. In respect to materials supply, whether for concrete or other pavements, Chicago is favorably located. It has within a radius of about 100 miles granite and trap rock, sandstone, brick, creosoted wood blocks, and beyond these limits rock asphalt is not very much further away; while within its local freight district are cement, sand, limestone, gravel, slag, asphalt, tar and flux oils. It is possible to lay the accepted highest types of pavement without an undue increase in costs due to freight charges on long hauls.

Aggregates are trucked in and piled on the streets where they are loaded usually by some type of bucket loader as shown by Fig. 1. Cement is commonly hauled









FIGS. 6-11—FINISHING METHODS ON CHICAGO PAVEMENTS

Fig. 6—Perforated roller pushes down coarse aggregate.
Fig. 7—Heavy wire mesh and strong axle keep roller rigid.
Fig. 8—Split float takes care of joints.
Fig. 9—Board belt gives first surfacing.
Fig. 10—Special float operated by circular sweeping movement.
Fig. 11—Finishing bridge for fine float work.

in on trailers which serve as charging platforms until unloaded when they are replaced by a loaded trailer and hauled away for new loads. The view, Fig. 2, shows a cement stock trailer. Haulage is by trucks, Fig. 2, truck tractors, Fig. 3, or sometimes by industrial railway. The usual types of mixer outfits are employed as shown by Fig. 4. It is chiefly in finishing that uncommon methods are employed.

Finishing—The concrete is finished by rolling and belting. Long-handle floats are permitted when necessary. Virtually all edges are tooled. Owing to the constantly changing cross-section, previously referred to, the use of a finishing machine is impracticable. Also for the same reason the same accuracy of surface as on rural concrete roads is not demanded; the allowable departure from a 10-ft. straight-edge is ⅜ in. It is considered that this less perfect surface has also justification in the slower speed of city traffic. In the group are shown finishing tools used by contractors; Fig. 4 shows the vibrolithic process in this case on alley paving.

TABLE—AVERAGE PRICES IN 1924 FOR CHICAGO PAVEMENTS

	Sq.Yd.	Total
Asphalt 6-2-1½	3.794	6.333
Asphalt 8-2-1½	4.207	7.293
Asphalt 8-2-1½ with brow paving	4.180	8.403
Asphaltic Concrete 6-2	3.20	5.803
Asphaltic Macadam	3.269	5.907
Brick 6-2-4	5.80	8.621
Portland Cement Concrete 6-2	3.915	6.548
Portland Cement Concrete 7-3	4.854	7.741
Portland Cement Concrete 7-3, with brow paving	4.852	9.104
Alley Concrete 7 in.	2.986	3.864
Alley Concrete 7 in. with sewer	3.00	5.036

Curing is effected by the use of wetted burlap and the application of calcium chloride to the extent of 2 lb. to the square yard; or of silicate of soda to the extent of 1 lb. per square yard, with the provision that when the temperature is above 80 deg. F. the silicate of soda may be reduced by the addition of 25 per cent of water; or also at the discretion of the contractor, by covering the pavement with 2 in. of earth or wetted straw. Between July 1 and Sept. 15 the pavement is kept closed to traffic for 14 days, in other working periods 21 days. Woven wire fences are set the length of the day's run along the curb lines to protect the work from being marred by animals, human or otherwise. On car-line streets, unless other arrangements can be made with the operating department of the company, platforms extending the full length of the car are provided at all car stops.

Costs—Only bidding prices are available to indicate costs. These were for 1924, as furnished by the Board of Local Improvements for all types of pavement, as given in the accompanying table. In the column headed total there are included besides the square yard item all collateral costs as grading, curbing, sewer adjustments, sidewalk connections, etc.

The data from which this article has been prepared have been secured on the work from contractors, from the Portland Cement Association and chiefly from John B. Hittell, chief engineer of streets, Board of Local Improvements, Chicago.

Countersunk Rivets as Strong as Buttonhead in Tests

TESTS of 168 riveted joints, carried out at the University of Wisconsin during the last three years, indicate that countersunk rivets are just as strong in shearing and bearing resistance as bottomhead rivets. There are differences between the two in the deformation of the joint under load, especially in the slip, but no recognizable difference in ultimate strength. The tests are reported by Prof. J. B. Kommers in "Comparative Tests of Buttonhead and Countersunk Riveted Joints," *Bulletin of the University of Wisconsin*, Vol. IX, No. 5, just published. The bulletin also contains valuable references to earlier findings on the strength of countersunk rivets, going back to Fairbairn's work in 1850.

Three series of tests were made at Wisconsin. In the first series, 54 single-rivet joints were tested, some lap and some single-covered butt, with plate thicknesses from ¼ to ¾ in. and rivet sizes from ⅜ in. to 1 in., the plate strips being 2½ in. to 3⅞ in. wide. The second series, 96 joints, included only ½-in. plate and ¾-in. rivets, but the joints were of lap, single-covered butt, and double-covered butt type, with 1, 2 and 3 rivets in various arrangements. The third series, 18 joints, dealt with double-covered butt joints with two and three rivets on a side, the main plates being 1 in. thick and the rivets ⅝ and ¾ in. in diameter. The joints of the first and third series were tested in tension only; in the second series some were tested in tension and some in bending, the latter by laying the joint across two supports and applying a load at the center of the span. All material was openhearth structural steel, rivet holes were punched ¼ in. small and reamed to ⅛ in. larger than rivet diameter, and rivets were driven in a pressure riveter. All the test joints were made by the Wisconsin Bridge & Iron Co., which with the Worden-Allen Co. furnished most of the material.

Strength of the Joints—The ultimate shearing values of the joints ranged from 49,400 to 55,900 lb. per square inch of rivet section (group averages). Eight sets of six lap joints showed shearing strengths of 49,400 for rivets with snap head and point, 52,300 for rivets with snap head and countersunk point, and 55,400 for rivets with countersunk head and point, the latter two values exceeding the former by 6 and 12 per cent respectively. The tensile stresses on the net section of the joint at ultimate load ranged from as low as 14,000 to nearly 59,000 lb. per sq.in., and the bearing stress ranged from 32,000 to 141,000 lb. per sq.in. In the tensile tests (108 joints) only four joints failed by tension in the plate. Eight other joints showed cracks in the edge of the plates or around the rivet holes due to tension. In 72 joints with countersunk rivets only one joint failed by pulling the head of the rivet through the rivet hole, the riveting here being apparently defective. Many joints showed elongation of the rivet holes, the enlargement being in some cases as much as ¼ in.

In the bending tests none of the rivets failed, although six joints were bent to angles of 57 to 89 deg. from their original straight condition. Four of these six failed by tension of the lower cover plate in bending.

Conclusions—Professor Kommers concludes from the tests that countersunk joints are at least equal to buttonhead joints in shearing strength, that the deformation at working load is 1.7 to 4 times as great for countersunk as for buttonhead joints, and the slip at the same load 3 to 8 times as great as for buttonhead joints; and that generally the countersunk joints show less rigidity than the other, in bending as well as in tension. Thus the results confirm and extend the indications of prior tests, which showed little or no observable difference in strength between countersunk and snap rivets, and they indicate also that current engineering specifications, which generally require a reduction of allowable stress for countersunk rivets, discriminate unduly against this type of connection.

Flood Control Work in Czechoslovakia

Flood control work on the Dyje River in Czechoslovakia is to be undertaken jointly by the government of Czechoslovakia and the local department of Moravia, according to *Public Works Review* (Czechoslovakia). A masonry dam about 170 ft. high is to be built in the upper part of the river valley to prevent the serious flooding of agricultural land and towns which now occurs in the river valley and also to control the flow of the river for hydro-electric development. It is estimated that 100,000,000 kw. of electric energy can be produced through the complete development of the power resources of the river.

Use of 300- and 500-ft. Tapes for Survey Traversing

Economy and Speed Increased—Charts for Slope Corrections, Vertical Components, Corrections Due to Temperature, Pull and Sag

By Harry Rubey

Acting Dean of Engineering, University of Missouri, Columbia, Mo.

TAPES 300 ft. or 500 ft. long offer many advantages over those of the usual 100 ft., advantages which apparently are not generally recognized. Their use is comparatively limited and little has been published concerning it. The writer has had parties under his direction use long tapes upon extensive surveys and finds that under favorable circumstances the speed, economy and precision of the work can be almost doubled. In all cases a satisfactory improvement is noted unless traffic interferes.

They may be used in either compass or transit traversing. With the compass they are used extensively in forestry surveys where the demands are for cheap traversing of low precision. The clinometer is here used exclusively for obtaining the slope angles. As use with the compass is similar to that with the transit, only transit traversing will be described here. Transit traverses show better precision with long than with 100-ft. tapes.

Fig. 1 shows the usual method of transit traversing with long tapes. It is not possible to keep the tape level and it is consequently necessary to measure the vertical or slope angle with a clinometer or transit. It will be noted that the elevations of the successive tape ends or transit points may be computed approximately and in some cases the results are sufficiently precise to avoid the necessity of the usual level party. To obtain the greatest precision in elevations, the angle —3 deg. 17 min. as indicated upon the sketch is measured with the transit and the difference in elevation obtained by multiplying the total horizontal distance between transit points by the tangent of the slope angle. Unless a fairly accurate determination of elevations is necessary the angle —3 deg. 17 min. is not read.

The rear end of the tape is first held at the end of the horizontal axis of the transit with the head end of the tape held at any convenient height above the ground. The slope angle to the head end is then read on the transit. Thereafter the head and rear ends are held at any convenient height above the ground and the slope angle read by the rear chainman with a clinometer. The distance of the tape ends above the ground does not affect the horizontal distances but does affect elevations. The head chainman holds the zero end of the tape and the rear chainman holds either the rear end or any required intermediate point. For intermediate points, a special clamping hand grip device enables the rear chainman to hold the tape against the heavy pull of the head chainman. The pull on these long tapes must be materially greater than for the 100-ft. tapes. The rear chainman keeps a notebook in which he records all taping data after he has made the necessary computations and reductions. He then marks the station and plus on the newly set stake as he reaches it. His data are copied into the transit book at the earliest possible moment.

Long tapes have larger errors due to sag, pull and temperature than short ones. Long tapes are usually their true lengths at about 68 deg. F. and with a 20-lb. pull, supported throughout their lengths. As they are seldom used under these conditions the accompanying diagrams, Figs. 2-7, have been prepared so that the corrections may be easily made. The precise curve for any particular weight and length of tape can be plotted upon these diagrams or data taken from the curves as given. While they appear somewhat complicated, a little use will enable a reasonably intelligent rear chainman to estimate the necessary corrections with little effort. Corrections should be made by the rear chainman before recording the slope distance. The transit notes given in connection with the diagram make the method clear.

Fig. 2 gives the amount to be subtracted from the slope distance for various slope angles and slope distances. The table is constructed by multiplying the slope distance by the versine of the slope angle. The diagram gives sufficient precision for ordinary surveys. Greater precision can be obtained by performing the multiplication. The value obtained from the table or by multiplication, subtracted from the slope distance gives the true horizontal distance.

Station	Distances		Difference in Elevation	Elevation
	Slope and Slope Angle	Horizontal		
21+95.2 ⊙				144.2
	453.2 +12°20′	442.5	+96.7	Note Intermediate elevations can be computed if desired
17+52.8			-74.7	
	422.8 0°0′	422.8	0.0	
13+30.2				
	471.2 -21°20′	439.2	-171.4	
8+91.2 ⊙				218.2

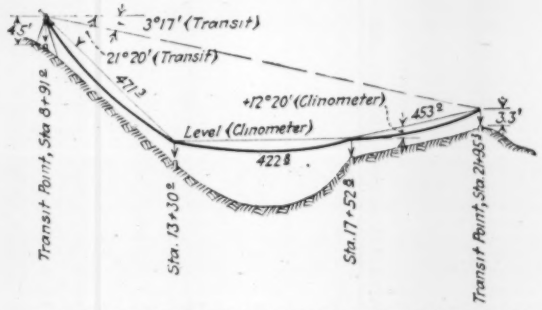


FIG. 1—TRANSIT TRAVERSING WITH LONG TAPES

Fig. 3 gives the vertical component of the slope distance or the difference in elevation between the ends of the tape. More precise results require the multiplication of the slope distance by the sine of the slope angle.

Fig. 4 shows the tape lengths at various temperatures, assuming the true length to occur at 68 deg. F. These corrections are seldom necessary.

Fig. 5 gives the stretch of the tape at various pulls. With the lighter tapes, these are sometimes important.

Fig. 6 gives the shortening due to sag when the tape is unsupported between the ends. This correction is important to obtain ordinary precision.

Fig. 7 gives the coefficients by which the sag correction for a full tape length must be multiplied in order to secure the sag correction for fractional tape lengths.

If the tape is neither freely suspended nor totally supported, an estimate of the sag correction must be made. Again, the greater the vertical or slope angle, the less the sag correction and in the extreme case of a slope

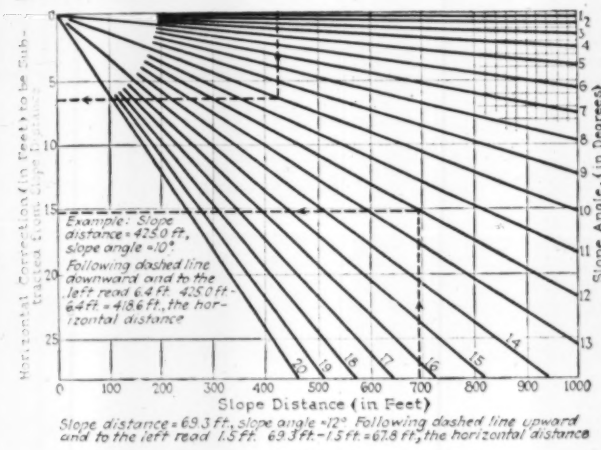

Horizontal Correction (in Feet) to be Subtracted from Slope Distance
Slope Angle, (in Degrees)
Example: Slope distance = 425.0 ft., slope angle = 10°. Following dashed line downward and to the left read 6.4 ft. 425.0 ft - 6.4 ft = 418.6 ft., the horizontal distance
Slope Distance (in Feet)
Slope distance = 69.3 ft., slope angle = 12°. Following dashed line upward and to the left read 1.5 ft. 69.3 ft - 1.5 ft = 67.8 ft., the horizontal distance

Fig. 2

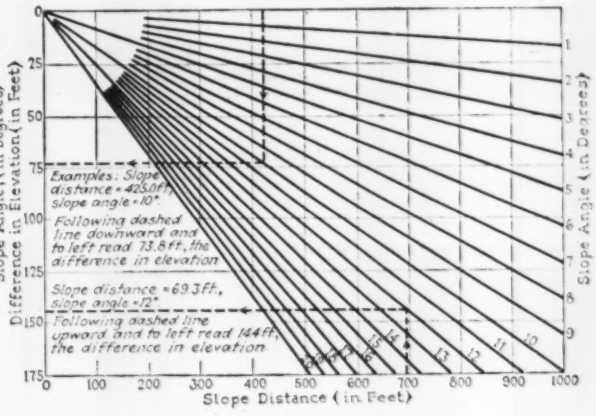

Difference in Elevation (in Feet)
Slope Angle, (in Degrees)
Examples: Slope distance = 425.0 ft., slope angle = 10°. Following dashed line downward and to left read 73.8 ft., the difference in elevation
Slope distance = 69.3 ft., slope angle = 12°. Following dashed line upward and to left read 14.4 ft., the difference in elevation
Slope Distance (in Feet)

Fig. 3

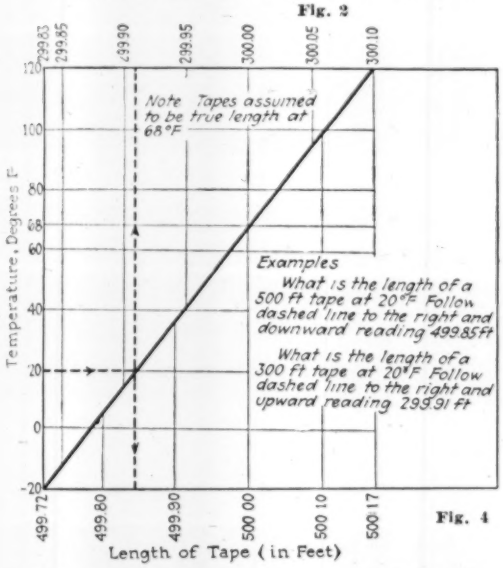

Temperature, Degrees F
Note Tapes assumed to be true length at 68°F
Examples
What is the length of a 500 ft tape at 20°F. Follow dashed line to the right and downward reading 499.85 ft
What is the length of a 300 ft tape at 20°F. Follow dashed line to the right and upward reading 299.91 ft
Length of Tape (in Feet)

Fig. 4

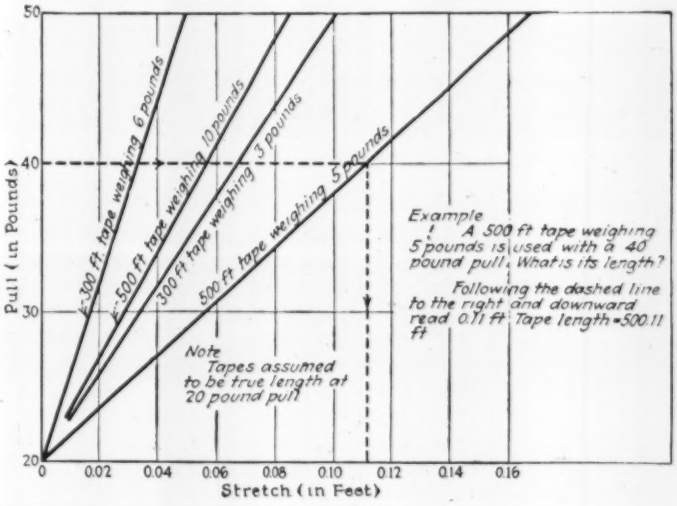

Pull (in Pounds)
300 ft tape weighing 6 pounds
500 ft tape weighing 10 pounds
300 ft tape weighing 3 pounds
500 ft tape weighing 5 pounds
Example
A 500 ft tape weighing 5 pounds is used with a 40 pound pull. What is its length?
Following the dashed line to the right and downward read 0.11 ft. Tape length = 500.11 ft
Note
Tapes assumed to be true length at 20 pound pull
Stretch (in Feet)

Fig. 5

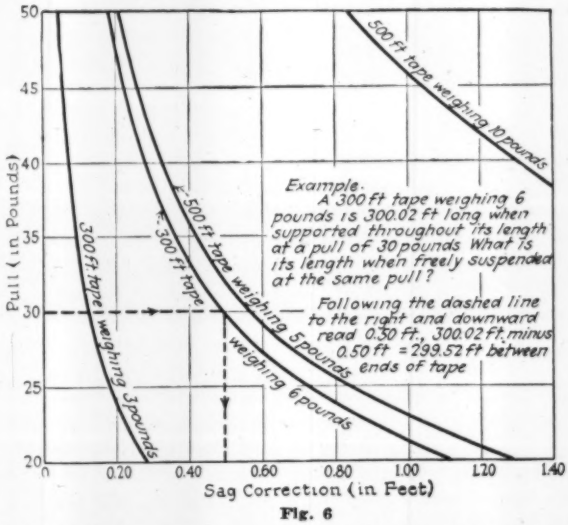

Pull (in Pounds)
500 ft tape weighing 10 pounds
300 ft tape weighing 3 pounds
500 ft tape weighing 5 pounds
300 ft tape
weighing 6 pounds
Example
A 300 ft tape weighing 6 pounds is 300.02 ft long when supported throughout its length at a pull of 30 pounds. What is its length when freely suspended at the same pull?
Following the dashed line to the right and downward read 0.30 ft., 300.02 ft. minus 0.50 ft. = 299.52 ft. between ends of tape
Sag Correction (in Feet)

Fig. 6

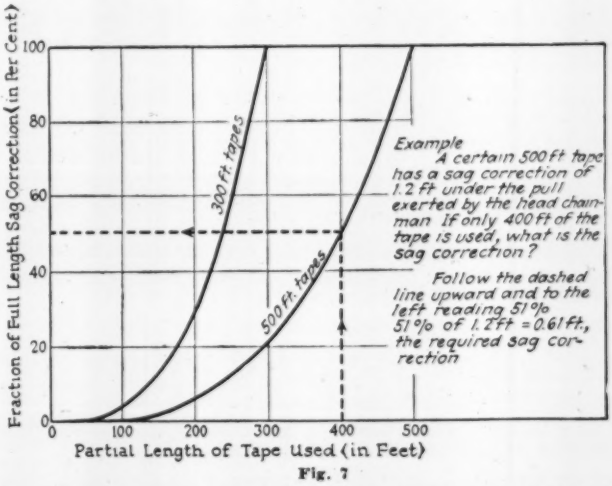

Fraction of Full Length Sag Correction (in Per Cent)
300 Ft. tapes
500 Ft. tapes
Example
A certain 500 ft tape has a sag correction of 1.2 ft. under the pull exerted by the head chainman. If only 400 ft of the tape is used, what is the sag correction?
Follow the dashed line upward and to the left reading 51%
51% of 1.2 ft = 0.61 ft., the required sag correction
Partial Length of Tape Used (in Feet)

Fig. 7

FIGS. 2 TO 7—CHARTS FOR FINDING CORRECTIONS IN SLOPE DISTANCE AND CORRECTIONS DUE TO PULL AND SAG

angle of 90 deg. the sag correction would be zero. The sag correction diagram of Fig. 6 is a proper one.

A study of the errors of taping with the usual 100-ft. tape will show that the longer tapes tend to give more precise results and this is borne out in practice. The writer is convinced of their economy and precision.

Long tapes may not be economical upon final locations where it is necessary to set stakes every 100 ft., but even here a third chainman or stakeman can set such stakes when the tape is stretched. Frequently it is customary, but not necessary, to have stakes 100 ft. apart in final locations, as for example in transmission lines.

Principles of Soil Mechanics: VII—Friction in Sand and in Clay

Complex Nature of Friction in Granular Masses as Compared with Solid Friction—Measuring Friction in Sand and Clay—Two Kinds of Frictional Motion in Sand—Hydrodynamic Effect on Clay Friction

By Dr. Charles Terzaghi
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Temporary Lecturer, Massachusetts Institute of Technology, Cambridge

SOIL movements are largely determined by the resistance of the soil to sliding motions within the mass. Soil friction, therefore, is of peculiar importance in soil mechanics.

It is common, and quite natural, to approach the study of friction in sand and clay by way of conceptions derived from current views on friction between solids. This line of approach is apt to lead into error, however. Granular friction is radically different from solid friction in almost every phase, and the two subjects require separate and quite distinct modes of attack.

Largely through the work of W. B. Hardy and collaborators in very recent years, remarkable insight into the phenomena of solid friction has been gained, and the action is now known to be far more complex than had been thought during the last century or two. The coefficient of friction between perfectly clean and smooth surfaces was found to be very high and constant. However, in practice no perfectly clean surfaces exist because contaminating matter spreads over every surface either by creep or by condensation and the presence of contaminating matter considerably reduces the value of the coefficient of friction. Water is called by Hardy an anti-lubricant because it has the property of increasing the value of the coefficient of friction between contaminated, smooth surfaces by partially compensating the lubricating effect of contamination. In no case was it found to act as a lubricant. Among lubricating oils of similar chemical character the power of reducing the coefficient of friction increases with increasing molecular weight. For uneven surfaces the coefficient of friction depends in addition on whether or not the pressure acting per unit of area of the surface of actual contact is high enough to permit the minute projections to cut through the lubricating film and produce incipient abrasion.

Although it thus involves a number of factors, solid friction is nevertheless a relatively simple phenomenon, from the physical point of view. The contacting bodies are constrained to move parallel to their interface, and conditions remain fairly constant as the motion progresses, provided the motion is very slow.

In contrast, motion between masses of individual grains is a very complex process, involving not merely surface friction but also translation and rotation of the grains. The complexity of the process betrays itself in the fact that the actual movement is preceded by an incipient one, caused by minor grain displacements. In short, frictional resistance in sand depends not only on the pressure and the nature of the contacting surfaces but also on the density of structure of the sand and on the thickness of the zone to which the grain movements are confined.

Internal Friction of Sand—Extensive experiments were made by the Foundation Soils committee of the American Society of Civil Engineers to determine the coefficient of friction of Ottawa standard sand (see *Transactions*, Am. Soc. C. E., 1917, 1920), but no simple and general conclusions have resulted thus far. A rather elaborate disk apparatus was used, in which the sand was confined within radially arranged compartments. The coefficient of friction was computed from the force required to produce a rotation of the mobile part of the apparatus. The coefficient of internal friction thus obtained was remarkably low, but varied considerably with the number of preceding runs. The coefficient for the friction between standard sand and the surface of standard sand mortar was found to be considerably higher than the coefficient for sand on sand. In each series of tests the coefficient sensibly decreased (at low and at medium pressure) with increasing pressure. The results show that the coefficient of friction even of standard sand is likely to vary between surprisingly wide limits, depending on the test conditions.

In fact, there is no definite single coefficient of friction. The value of the coefficient depends both on the manner in which slip is produced and on the changes in structure of the sand prior to the slip. On theoretical considerations as well as by the results of experimental work, the author has been led to distinguish between two fundamentally different cases:

(a) Separation of a mass of sand along a plane: Within the zone of slip there is complete rearrangement of the grains. Since Reynolds' classical experiment with the sand-bag we know that the grains of a mass of sand cannot change partners unless the volume of voids of the sand temporarily increases. Hence the separation along a plane requires a gradual loosening up of the structure of the sand in the vicinity of the plane of separation, i.e., the separation involves a tendency toward increasing the volume of voids. The coefficient of friction along a plane of separation is called the *coefficient of internal friction.*

(b) Continuous deformation of a mass of sand: If a mass of sand is uniformly stretched or compressed so that the displacement of the grains occurs throughout the whole mass, the stability of the structure increases and finally assumes a maximum. In this limiting stage the frictional resistance which determines the ratio between the extreme principal stresses is the *coefficient of internal resistance.* Its value represents the maximum value which the coefficient of friction can assume within a mass of sand of a given density. It may be considerably greater than the slope of repose.

Cases (a) and (b) are limiting cases; there is an infinite number of intermediate possibilities, each of which corresponds to another type of internal displacement, involving another coefficient of friction, limiting the state of equilibrium for that particular type of displacement. Thus the value of the coefficient of internal

friction depends on whether the slip is confined to a zone only a few grains in thickness or whether it occurs within a layer ten times as thick. This seems to be the chief reason for the disagreement between the results of large-scale retaining-wall tests and miniature tests.

The friction tests of the Foundation Soils committee are a notable example of the utter complexity of the frictional resistance in sands. It is timely to conclude from these and similar experiments that there can be no hope of exactly determining the value of the coefficient of friction required for calculating the outcome of more complicated earth pressure phenomena in sands. We can only guess at that value by choosing some intermediate value between the extreme ones or by indirectly computing it from what has been observed.

Internal Friction in Clay—In the case of sand, then, popular conceptions of the nature of frictional resistance are widely at variance with the physical facts. The same thing is even more true for clay.

Be it stated in advance: Experiments to determine the coefficient of internal friction of clay must (a) exclude the surface tension of the capillary water, because this tension produces internal pressures in addition to the pressure applied externally, and (b) take account of the fact that the frictional resistance depends not only on the intensity of the pressure but (within limits) also on the length of time during which the pressure acts.

Suppose the plane surface of a mass of air-free wet clay is under a definite external pressure. When the pressure is increased the clay body becomes smaller, like any other elastic body. As the voids of the clay are filled with water, the increase in pressure involves escape of the excess water. But as the permeability of the clay is very small, the escape of the water proceeds very slowly. During the drainage process part of the excess pressure is compensated for by a corresponding hydrostatic pressure of the water in the voids; the surcharge partly floats on the surface, so to say, and only the surplus is carried by the solid parts of the mass. Immediately after the surcharge is applied, the compression of the clay is practically equal to zero, hence the hydrostatic pressure at this time is almost equal to the surcharge. While the excess water gradually escapes, the hydrostatic pressure becomes smaller and approaches the value zero. The speed of decrease evidently depends both on the coefficient of permeability of the clay and on the thickness of the clay layer. A hydrostatic pressure does not produce any static friction. Hence it is merely the remainder of the surcharge which counts. The frictional resistance increases with decreasing hydrostatic pressure, and does not assume its normal value until the excess water has completely escaped from the layer of clay.

Herein resides the physical cause of the slipperiness of the surface of fat clays. If one steps suddenly on a very slightly inclined clay-surface the foot slips, although even a very fat clay has a fairly large internal friction (friction angle at least 11 deg.). In the rapid application of the pressure of the foot, the greatest part of the weight of the body is compensated for by hydrostatic pressure, and the friction produced by the remaining weight is not sufficient to prevent the slip.

Certain types of landslides involve a similar phenomenon. The slide is preceded by the formation of shrinkage cracks or other open spaces, in which water accumulates. Due to some spontaneous displacement in the fissured material part of the weight acting in the trapped layer of water compensates part of the weight of the settling material with a speed corresponding to almost zero friction on the sliding plane. This phenomenon, in which the coefficient of friction may temporarily go down to 0.05 or less, is commonly accounted for by the lubricating action of the water. In fact it is merely due to a spontaneous partial compensation of the weight of the overburden by the hydrostatic excess pressure acting in a layer of trapped water.

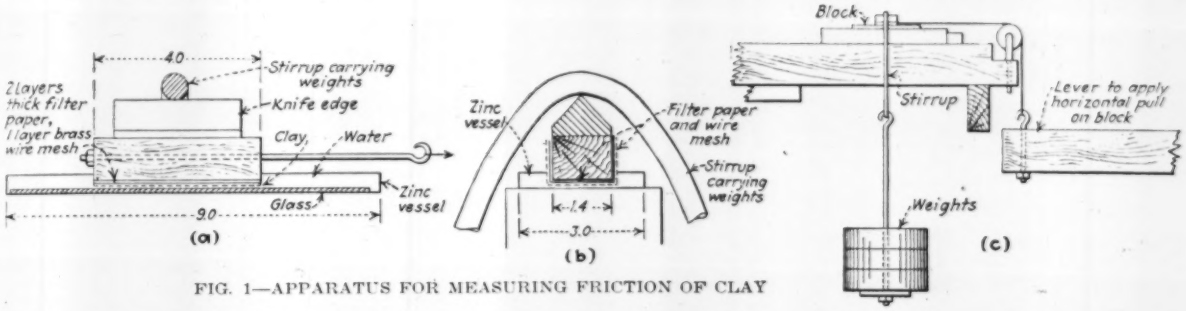


FIG. 1—APPARATUS FOR MEASURING FRICTION OF CLAY

Friction Apparatus—In order to fulfill the requirements essential for a successful test, the author investigated the internal friction of clays by means of the apparatus represented in Fig. 1. A pan of zinc has its bottom covered with a sheet of glass. For determining the coefficient of friction between glass and clay, the glass sheet is covered with a thin layer of plastic mixture of clay and water (free of air). On the layer of clay is placed a prismatic block whose base and sides are lined with two layers of thick filter paper and one layer of No. 20 brass wire mesh. The brass mesh acts as a rough surface, which takes the clay with it, and the filter paper serves as a drain for the excess water. Load is applied by weights hung from a stirrup resting on a knife-edge above the loading block. The load usually reduced the thickness of the layer of clay to about 3 mm. Finally all the clay fragments projecting beyond the edges of the base of the loading block were scraped away and the zinc vessel was filled with water. Horizontal pull was applied to overcome the frictional resistance, by means of a cord leading over a pulley to the end of a loading lever.

The friction tests were never started earlier than 24 hours after the load was applied, a time sufficient for draining the thin layer of clay or allowing it to become resaturated. When it was desired to measure the coefficient of frictional resistance of clay on clay, the glass plate was replaced by a double layer of filter paper covered with a brass wire mesh.

This test arrangement is far from being ideal,

because the tests require much care, time and experience. However, for the time being it is the only one which fulfills the above-mentioned first condition for a successful test. Further efforts will be required for developing a more convenient and perfect device.

Friction Test Results—The results showed the coefficient of friction of clay to be remarkably constant for pressures of more than about 1 kg./cm.², and to be remarkably independent of many of the factors which distinctly influence the coefficient of friction of sands. This seems to be due to the fact that fat clays consist of thin and very flexible flakes, while sand is composed of bulky, fairly rigid grains. The structure of sand does not allow change of shape without change in volume of voids (sandbag experiment of Reynolds), while clay is capable of plastic deformation (deformation at a constant volume of voids).

The coefficient of friction between glass and clay is about 0.18 to 0.22 for colloidal mud, 0.23 to 0.30 for fat clays, and 0.30 to 0.32 for sandy clay. The respective coefficients of internal friction of the clays are 0.23 to 0.28, 0.25 to 0.40, and 0.40 to 0.50. The coefficients of internal friction and of internal resistance seem to be almost identical. Hence each kind of clay has its definite coefficient of internal friction. Herein lies an essential difference between sand and clay.

The sliding of clay on the smooth surface of the glass sheet occurred suddenly, as soon as the pull exceeded a threshold value. Motion along an interface located within the clay, on the other hand, proceeded rather gently, resembling somewhat the flow in a very viscous liquid. The initial friction, corresponding to zero pressure, amounted to about 20 g./cm.² The smaller the pressure, the greater was the influence of initial friction on the value of the coefficient, as may be seen from the high values at the left-hand end of curves, Fig. 2.

In each test, actual motion was preceded by an incipient motion, usually starting as soon as the pull became equal to about six-tenths of the threshold value. The incipient motion seems to be caused by the structure of the stretched clay adapting itself to the changing state of stress. If the pull was left constant before it had attained the threshold value, the incipient motion continued with decreasing speed and ceased completely within twenty-four hours. After this a further increase of pull produced no detectable incipient motion whatever.

For clays the coefficients of internal friction and of internal resistance seem to be almost identical. In a preceding paper I have shown that the shearing strength of a plastic sample of clay is equal to the product of capillary pressure times the coefficient of internal resistance. Hence there is a contradiction between the low coefficient of internal resistance and the great cohesion of certain fat clays, explained by the great intensity of the stress acting in the capillary water of these clays.

The Foundation Soils committee, in investigating the internal friction of clays, used a device similar to the one described for sand tests at the opening of this article. But the essential requirements for obtaining normal values for the coefficient of internal friction were not fulfilled. The Kentucky ball clay with 10 per cent and 25 per cent water, respectively, undoubtedly contained considerable quantities of air, or else the cohesion effect would have been far greater than that actually measured. The coefficient of friction was of the order 0.25 (0.23 to 0.27). The tests made with a mixture of clay with 39.54 per cent of water furnished an exceedingly low value of friction coefficient which clearly proves that the greatest part of the surcharge was compensated for by hydrostatic pressure, i.e., the test was made a long time before the excess water had completely escaped. In a test of such a kind the clay is not yet in hydrostatic equilibrium, and the test may furnish any friction value between zero and the normal value. Such values are not the coefficients of static friction, but coefficients of what may be called the momentary hydrodynamic friction; they depend on the pressure which acted on the clay prior to the time when the surcharge was applied, on the time during which the surcharge was allowed to act, on the thickness of the layer, and on various other factors.

Conclusions—The quantitative side of every earth-pressure phenomenon depends on the intensity of the

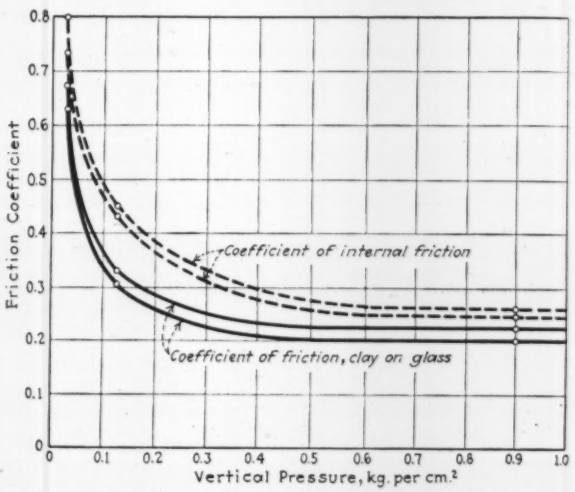


FIG. 2—STATIC FRICTION OF YELLOW CLAY

frictional resistance acting within the soil. Through decades of years the development of soil mechanics has been handicapped by the traditional habit of identifying the laws which govern the frictional resistance in granular masses with those derived from friction tests performed with solid bodies. In the preceding the attempt has been made to characterize the phenomena of sand and clay friction and to indicate their quantitative features.

On the basis of these considerations taken in conjunction with the elaborate studies of Hardy and others on friction between solids with and without lubricants, the following statements may be made:

(*A*) Friction between smooth and absolutely clean surfaces of solid bodies is a purely physico-chemical process and is caused by direct molecular interaction.

(*B*) Friction between imperfectly smooth surfaces of solid bodies involves not only these physico-chemical causes but also a file-like action of each surface on the other. Nevertheless, from a physical point of view the phenomenon is a simple one.

(*C*) In sand the friction coefficient depends not only on the properties of the grains and the structure of the sand, but also on the nature of the process which causes the slip, and on the nature of the process which preceded the slip. It has no definite value, but may be anywhere between two limiting values, (a) the coefficient of internal friction (friction acting along a plane

of separation), and (b) the coefficient of internal resistance (resistance which develops while the entire mass suffers a uniform deformation).

(*D*) In clay the friction coefficient for medium and for high pressures is remarkably constant. For low pressures, however, the value of the coefficient increases with decreasing pressure, because initial friction plays an important part, amounting to about 20 g./cm.^{2} Rapid change of pressure produces in the liquid component of the clay a positive or a negative hydrostatic pressure. The coefficient of friction does not assume its normal value (coefficient of static friction) until the hydrostatic pressure has become zero throughout the whole mass. In the preceding stage of the process the coefficient of friction (coefficient of hydrodynamic friction) may have any positive value, and is a function of the time.

Unusual Combination Trusses in Old Bank Building

Floors Over Banking Room Carried by Individual Trusses With Cast-Iron Tubular Compression Chords

INTERESTING truss construction carrying upper floors to avoid the necessity for columns in the banking room below were revealed in the demolition of the old building of the Seamen's Bank for Savings, 74-76 Wall St., New York City. These trusses, spanning about 40 ft., are shown in the two views herewith; Fig. 3 shetches their location.

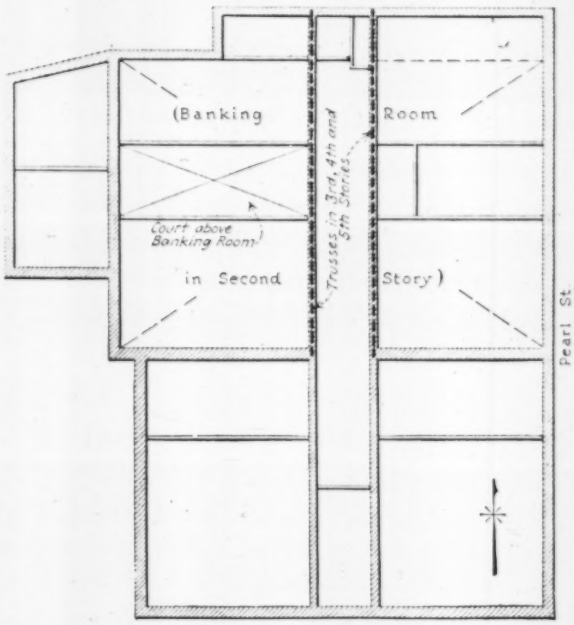
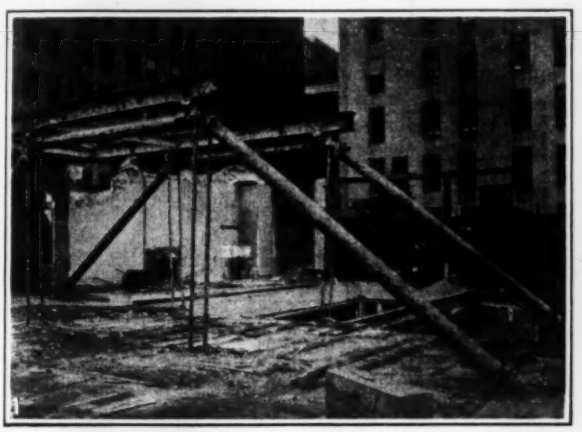


FIG. 3—SKETCH OF TRUSS LOCATION



FIGS. 1 AND 2—TWO VIEWS OF OLD TRUSSES IN SEAMEN'S BANK FOR SAVINGS, NEW YORK

The banking room, occupying the rear of a high story directly over a low ground-floor story, was spanned by the two trusses in north-south direction, on the line of the partition walls of corridors in the three office stories above. The designers appeared to fear to hang the weight of three floors from a single truss, or possibly believed that this would involve undesirably large sections of members. At any rate, they used a separate truss for each story, as may be seen in Fig. 1, where the floor shown is that directly above the banking room, or the third floor. The truss whose cast-iron compression chords are seen in this view carried the third floor only, while the fourth floor was carried by a similar truss directly above, whose tension chord, burned apart but with the lower portions of the suspender rods still attached, is seen superimposed on the truss below.

R. G. Hatfield was the architect of the bank building. His plans are dated 1870, and the structure was built in 1871 by Marc Eidlitz. At present the bank is erecting a 20-story bank and office building on the same site, slightly enlarged by the purchase of adjoining lots, and the old buildings have therefore been torn down, this work being just completed. In its 54 years of existence the building has given uninterrupted, satisfactory service, from which it may be concluded that the truss construction was entirely adequate for the purpose designed.

Philippines Have Many Water-Works Systems

Including the Manila metropolitan water system, there were in use supplying potable water in the Philippine Islands at the close of 1924, 123 water-works systems, with 35 more under construction and 101 under consideration. According to the 1924 report of the Philippine Bureau of Public Works, the 122 systems other than the one for the Manila district supply a total population of 378,381, and cost 4,481,119 pesos, or half as many dollars. The 35 works under construction will provide potable water for 115,000 people and 101 projects under consideration would supply 378,400 more.

One of a Series of Articles on the Details of Design and Layout of Different Types of Industrial Buildings

Reconstruction of a Paper Mill in Washington

Machinery Kept in Operation While Old Building Is Replaced with a Structure of Steel and Reinforced Concrete—Walls of Wire Glass and Steel Sash

By R. A. Huestis
Engineer for the Austin Co., Seattle, Wash.

IN ENLARGING and reconstructing the paper-machine room of the Inland Empire Paper Co., at Millwood, Wash., the necessity for continuous operation without loss of production determined the design and construction. This work was completed with only one forced shut-down of two hours for one machine while changing a fourdrinier screen that was damaged by a splinter. The completion of this building, shown in Fig. 1, marks another milestone in the rapid replacement of old frame buildings with more fire resisting construction by the paper industry throughout the country. Fig. 2 is a plan of the second floor and Fig. 3 is a cross-section showing the old and new structures.

FIG. 1—NEW PAPER MACHINE ROOM; INLAND EMPIRE PAPER CO.

The old machine room as originally built was 72x256 ft. and two stories high. Its first floor was of concrete laid on the ground. The second or machine floor was of heavy timber frame construction. In both stories

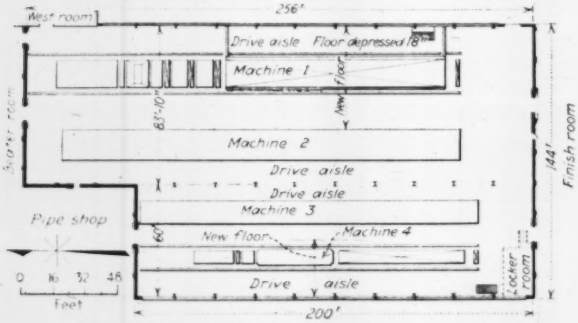


FIG. 2—NEW SECOND FLOOR OF PAPER ROOM

the walls were of frame construction, with double-hung wood sash. The roof, which was supported by timber trusses, was sheathed inside on the bottoms of the purlins with V-joint ceiling to furnish an air space. At a later date a reinforced-concrete machine foundation and a first story exterior wall at machine 2 (Fig. 3) were built, and still later machine foundation 3 was added to the west side. This addition consisted of cast-iron columns, structural steel beams and girders and concrete floor slab; it had frame walls in both stories and a joist roof supported by trussed beams. The first story housed the engines, drive shafts, save-alls, pumps, heaters, fans, beaters and various other equipment.

In planning the reconstruction it was decided, after a study of the plant, to replace all timber portions of the machine room with reinforced-concrete second floor, steel columns and trusses, and walls of brick and steel sash. At the same time the building was to be widened 40 ft. to allow for one new 158-in. machine foundation. Two new machine foundations were to be built, 1 and 4, with machine 1 moved to location 4 (Fig. 2).

Design Features—All measurements were obtained while the machines were in operation, for (as is customary) the operation is continuous through the week, with a shut-down on Sunday to allow for cleaning and necessary repairs and replacements.

The west side (Fig. 2) includes a 30-ft. width of floor and 60 ft. of roof and is 200 ft. long. The first-story wall is of 10-in. concrete reinforced with ½-in. round bars spaced 18 in. c. to c. in both directions. There are two five-light steel sash per bay. The second or machine floor is of beam and girder type, the machine foundation consisting of girders 12x32 in. with columns 20 ft. c. to c. The machine weighs approximately 400 tons. The drive aisle and the aisle between the machines are designed for live-loads of 250 and 300 lb. per sq.ft., respectively. All floor slabs are pitched to the gutters adjacent and parallel to the foundation girders. The west wall is of 9-in. brick to the height of the concrete sill, above which is continuous steel sash with a built-up horizontal mullion for stiffening. Col-

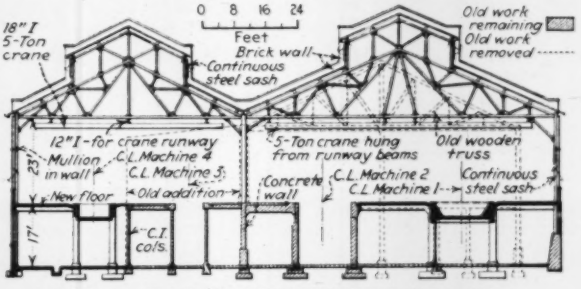


FIG. 3—CROSS-SECTION SHOWING NEW AND OLD BUILDING

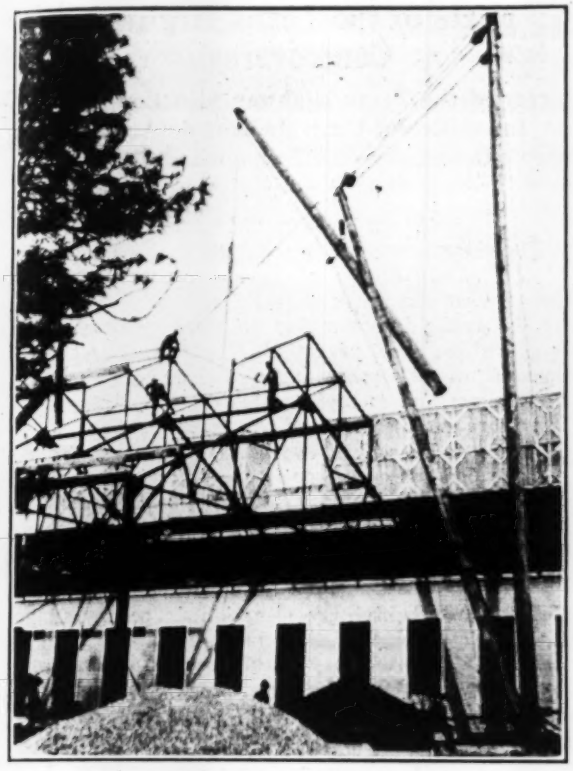


FIG. 4—DERRICK WITH "MONKEY" ON BOOM

umns of H-beams spaced 20 ft. c. to c. carry the roof trusses.

Over machines 3 and 4 the roof is carried by 60-ft. steel trusses of the Fink type, with a 32-ft. monitor; they are designed for a 5-ton crane load at any point. The roof consists of 6x12-in. wood purlins and 3-in. matched plank. Continuous sash forms the sides of the monitor and has ventilating sections operated from the floor. With the lower chords of the trusses 23 ft. above the floor there is ample clearance over the calender stacks for the traveling crane.

Three lines of 12-in. I-beams bolted to the lower chords of the trusses form the tracks or runways for trolleys carrying the traveling crane, which has an 18-in. I-beam with several trolley hoists and chain blocks

FIG. 5—TEMPORARY HOUSING OVER PAPER MACHINE

Structure at right encloses machines in operation. Left half of old wood roof trusses and floor cut away for new work. End of traveling crane supported on shoring.

running on the bottom flanges. One 12-in. I-beam is hung from the lower chord of the first truss over the center of the rewinders on each machine; on this beam the hoist for changing rolls operates.

On the east side, the wall from first to second floor is similar to the west wall, except that for 90 ft. at the south end it rests on an old gravity retaining wall (Fig. 3). The second floor, 50x256 ft., consists of two lines of girders spaced 15 ft. 8 in. c. to c., which support a 158-in. paper machine weighing approximately 900 tons. These girders also carry the floorbeams of both drive and machine aisles. Columns are spaced 16 ft. c. to c. and haunches are used on the girders to stiffen the frame.

The drive aisle is similar to that of machine 4, except that the portion opposite the dryer rolls is depressed 18 in. to allow for driving gears. The machine aisle between machines 1 and 2 is designed for a 400-lb. live-load. It is of beam and slab type, with 6-in. slab and beams 8 ft. c. to c., the beams resting in seats cut in the old concrete girders under machine 2.

Trusses similar in design to those over the west half, but of 83-ft. span, cover machines 1 and 2. At the north and south ends of the room, 13-in. brick fire-walls extend from the second floor to above the roof line. All openings in these walls are equipped with double fire doors which separate the machine room from the beater room on the north and from the finishing room on the south. The walls are pilastered and carry the roof and floor loads of the adjacent buildings. These walls are finished with a reinforced-concrete coping.

Construction Work—Construction was started on the west half of the building on March 1, 1925, and was completed May 10. All concrete work on this portion was built outside the existing building. It was only necessary to remove the wall sheathing and some of the studs where the new second floor joined the old.

When concrete in the second floor had set sufficiently, steel erection was started. Holes were cut in the old roof above the central concrete wall and through these the new steel columns were set in place by means of a "monkey" attached to the boom of the guyed derrick, as shown in Fig. 4. The trusses, which were riveted together in the yard, were brought alongside the building with a locomotive crane. From this position they were picked up by the derrick. Purlins and eaves struts were also set in place with the "monkey." A steam hoist was used for the derrick and an auxiliary gasoline hoist controlled the "monkey." The brick fire-walls were carried up as the steelwork progressed and when the first few bays were braced the roof sheathing was placed. This was completed in 3½ days. All roof lumber was primed before erection.

When this side of the building was completely enclosed, the old building housing machine 3 was wrecked. This work was done on Sunday so that no shut-down was necessary, and every precaution was taken so that no parts of the machine would be damaged. With this portion of the work completed, the small paper machine was moved to location 4 and the construction plant was then moved to the east side of the building.

A temporary waterproof roof was constructed on the lower chords of the old wooden trusses over machine 2, as shown in Fig. 5, the east wall of this temporary enclosure being composed of the old dryer felts. The whole roof and outer half of the trusses were then wrecked as well as enough of the old timber machine

floor to permit building the complete forms for the new machine pits. This left an aisle along machine 2, so that the crane could be used in making repairs and replacements.

When this part of the wrecking was completed, forms were built and the concrete footings, walls and floor were poured to the center line of machine 1. The brick fire-walls were carried up simultaneously with this work. Steel erection was begun when the concrete had set sufficiently to carry the guyed derrick. The trusses were riveted together in the yard and brought to the south end of the building with the locomotive crane. Small cars running on wood rails then transported the trusses to the north end, where erection was started. When the derrick had moved back sufficiently, the trusses were picked up directly from the locomotive crane.

When the east side was completely housed in, the temporary construction over machine 2 was wrecked. As before, this work was done on Sunday so that no shut-down resulted. The remainder of the old floor was

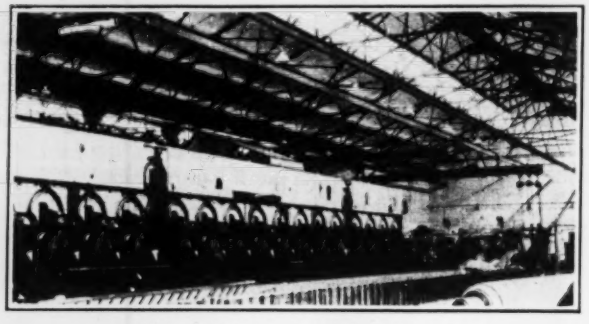


FIG. 6—PAPER MACHINE ROOM
Note traveling crane with trolley hoisting blocks at right.

then taken up as the formwork progressed, so that there was working space for the machine tender at all times. Because of the equipment on the first floor, shoring for forms was very difficult. On account of the vibration set up by the running machine and in order to allow the finish to harden, it was decided to pour this portion on Sundays. It was done in three pours and the work was completed on Aug. 26, 1925. Fig. 6 is an interior view at machine 2, and shows the suspended traveling crane with its trolley hoists.

Miscellaneous Features—All floors were finished as monolithic concrete and steel troweled to a hard, smooth surface. The second floor slab was wet down continuously for one week after pouring. Floor hardener was used where heavy trucking is done. Steel sash is glazed with ¼-in. ribbed wire-glass. A locker room with toilet facilities and five showers was placed on a mezzanine floor between the first and second floors. The interior surfaces of the steel sash and the structural steel were painted with one coat of acid-proof paint after erection, while the entire interior of the second floor received one spray coat of lead and oil gloss paint.

Only the closest co-operation between the mill and contractor's forces made this construction work possible. The new machine room was designed and built by the Austin Co., which has its main offices at Cleveland, Ohio. The design was under the supervision of R. F. Bell, district engineer, and the erection was under the direction of William F. Hammar, district superintendent. Clifford Pitcher was the resident superintendent.

Facts of the Texas Highway Controversy

Survey of the Texas Highway Situation Leading to the Recent Court Judgments Against Contractors for Excessive Profits

By J. M. Howe
Civil Engineer, Galveston, Texas

The newspaper prominence given to the muddled state highway affairs of Texas with the certain danger that sweeping generalities would be drawn by the public derogatory of all state highway administration, has prompted Engineering News-Record to seek a presentation of facts by an engineer in position to report intelligently. Arrangement was made with J. M. Howe, M.Am.Soc.C.E., of Howe & Wise, civil engineers, Galveston, Tex., and his findings are given in the following article. In connection it is important to note Mr. Howe's statement to us in submitting his report—"the statements given are not personal opinions but can all be substantiated."—Editor.

THE TEXAS highway situation is occupying so much front page newspaper space than an account of what is happening may be of interest to engineers and road contractors. To grasp fully the present situation we must, however, go back to the election in the summer of 1924 and explain the conditions that made possible the election of Miriam A. Ferguson to the gubernatorial office. For several years prior to 1924 the state had been torn apart, politically, by the Ku Klux Klan issue and in the 1924 primary the Klan was practically the only issue. The Klan had gotten into such ill favor that it appeared certain that an anti-Klan candidate would be elected; as a consequence there were a large number of anti-Klan aspirants for the governorship. James E. Ferguson, after announcing himself as a candidate, was disqualified by court action on account of his previous impeachment. His wife then took his place on the ballot. The result of the first primary, in which there were nine candidates, placed the Klan-supported candidate and Mrs. Ferguson in the second primary run-off. The Klan being the only issue, the anti-Klan strength concentrated upon Mrs. Ferguson and she received the nomination. Texas being a one party state, nomination is tantamount to election.

Mrs. Ferguson took office in January and two new highway commissioners were immediately appointed. Mrs. Ferguson's predecessor had already, as a courtesy to his successor, filled a vacancy on the commission with an appointee named by her. The entire board were therefore of her selection. As soon as the board took office the state highway engineer resigned. The new commission quickly brought upon itself the criticism of the engineers of the state by its arbitrary change of maintenance superintendents and foremen, replacing with political appointees the men working under the division engineers. This action brought out the resignation of a number of the division men, as well as that of the state maintenance engineer.

Prior to January, 1924, the counties in Texas had complete jurisdiction over all road maintenance and construction, the state highway department having only supervisory authority over state and federal aid work. On Jan. 1, 1924, the state under a former highway

commission took over the maintenance of state highways, and during the year of 1924 this maintenance work was handled without scandal and without material criticism in spite of the fact that no competitive bidding was required.

In June, 1925, there went into effect an amendment to the law, which authorized the state to take charge of both maintenance and construction on state highways and required competitive bidding on all work. It was during the interim between January and June of this year that the Ferguson commission let the contracts without competition that have caused all the furore.

The first rumblings of discontent came with the letting of the contracts for maintenance. There was in the letting of these contracts some pretense of competition in that selected contractors were invited to bid, but there was no advertising or general notice through the press that the contracts were to be let. The selected contractors were invited to offer proposals on a lump sum basis for maintaining designated sections of the highways for one year, payments to be made monthly and bond furnished for faithful performance. The specifications are given herewith.

(1) Maintain the wearing surface of all highways in first-class condition.
(2) Restore and build up the base of said highways in such places as may become necessary.
(3) Maintain adequate shoulders at all places.
(4) Maintain properly slopes of embankments and cuts.
(5) Keep borrow pits and drainage ditches open.
(6) Prevent erosion of roadway.
(7) Maintain fences.
(8) Keep structures painted and in good order.
(9) Keep grass and weeds mowed on the shoulders.
(10) Patrol highways.

They are brief, but not very specific. The question of who was to furnish material for repairing the roadway was not made clear. Later developments proved that the state was to furnish this at cost plus ten per cent. When these contracts were attacked, the highway commission compared the contract price with the cost for the previous year and in nearly every instance the new contracts showed material savings on the old contracts. This, of course, was natural, as the new contracts do not cover material whereas in the contracts for the previous year were included both labor and materials. In the county where the writer resides the maintenance cost for 176 miles of state highway in 1924 was $154,000, while the Ferguson commission let a contract presumably for the same work for $60,000 and claimed credit for a saving of $92,000. No mention was made of the fact that material would have to be added to the $60,000 price. Maintenance under the above specifications has been about what has been expected with the enforcing of these contracts largely in the hands of inexperienced political maintenance superintendents. These maintenance contracts have not been delved into very deeply by the newspapers or court on account of the more spectacular developments in the asphalt topping cases.

Asphalt Topping Cases—There are three of these, two of which have already been through the courts on injunctions and the third will have probably been settled by the time this is in print. The first case taken into court was a comparatively small contract for about one hundred miles of ½ gal. of asphalt and 1/66 cubic yard of crushed stone to the square yard. The contract price was 32c. per square yard. This contract was attacked through injunction by a group of taxpayers on the grounds of waste of public funds and exorbitant unit prices. The State Attorney General attended the trial as a spectator, and upon hearing the evidence proving that 17c. was a fair price for the work to be done where the contractors furnished the cover material, he started suits in the two larger contracts.

The facts of the largest contracts as brought out by the trial are brief; the contract was let without competition for the application of from one-half to one gallon of asphalt to the square yard at 30c. per square yard. Where cover material was used the state was to furnish it at cost plus ten per cent. The contract covered about a thousand miles of road and involved nearly $3,000,000 exclusive of the profit on the chats and extra work. The contracting firm was incorporated for only $50,000 and was not required to make surety bond. It sublet the work at less than 10c. per square yard.

The Attorney General's suit was for injunction to stop payments on vouchers, to cancel contract, to oust the corporation from the state and to recover part of the enormous profits. The court found that the contractor had been paid $1,203,269.25 and held approved unpaid estimates for approximately $130,000; and that the cost to the contractor of the above work was approximately $400,000, leaving a contractor's profit of approximately $900,000. The court found further, "that the money paid and to be paid to the American Road Co. for the work done under said contracts is grossly excessive and unconscionable." The contracting firm compromised by offering to repay to the state $600,000, cancel the contract and go out of business.

When these facts became known the storm broke over the Fergusons and the highway commissioners.

It was a matter of common knowledge in the state that James E. Ferguson was even more than "the power behind the throne." He represented the governor in highway matters and while not an ex-officio member of the commission he sat with them in their deliberations. It was impossible for him to shirk responsibility for their acts and when the contracts were attacked by the Attorney General in the name of the people of the state, the Governor employed counsel to intervene in an effort to have the suits quashed. This caused more criticism and the newspapers again brought out some of the things that had been done by the administration that, while not proscribed by law, were not entirely ethical. Among these were the employment of Mr. Ferguson by the owner of a railroad, which was benefited by certain laws passed at the last legislative session; that the Governor's daughter was a partner in an agency handling surety bonds on state contracts; that a weekly paper, "The Ferguson Forum," run by the Governor's husband solicited and received advertisements at exorbitant rates from road contractors and material and implement men; that the Governor had pardoned, paroled, or restored to citizenship over 1,000 of the state's criminals. The highway scandal was the climax and the Governor's apparent reluctance to ask for the resignation of the commissioners brought on a demand for a called session of the Legislature to consider impeachment. The belated resignations of the two commissioners responsible for the asphalt contracts, the court procedure stopping further work under the contracts and the appointment of two new commissioners, combined with the difficulties of calling the Legislature

together without the Governor's sanction have apparently postponed indefinitely an extra session.

The whole highway trouble was made possible by the failure of the Legislature to safeguard the contracts by requiring competitive bids. It was apparently the intention of the Legislature of three years ago when it authorized the state to take over maintenance in January, 1924, to have the work done with state day labor forces. This proved impracticable on account of lack of personnel and state-owned equipment, so the work was contracted out by the former commission. The Ferguson commission worked under the old law until June, 1925, when the requirement of competitive bidding went into effect.

Owing to the state not being a party to the suit in the first injunction case filed, that suit will have to be retried and there is still another contract, the stoppage of which by permanent injunction is set down for the middle of this month. This later contract covers 600 miles of topping under practically identical conditions with the ones surrounding the thousand mile contract previously described. With these two cases on the docket and the Grand Jury continuing its investigation, there will probably be additional history made in the Texas state highway troubles during the next few months.

Life of Ties Measured by New Method

Diagram and Table Enable Probable Life of Groups of Ties to Be Determined from the Annual Rate of Renewal

AS A means of determining the life of both treated and untreated ties on the basis of mathematical law, rather than by records of failures, an extended diagram of curves of failure has been devised, showing graphically the rate of removals when the average life is from four to thirty years. With this diagram and an accompanying table of percentages of removals, the length of service to be expected from any group of ties can be determined, as the accumulated percentages will indicate which curve of failure is being followed, thus giving the mean or average life of the group. This system has been worked out by W. F. Goltra, president of the W. F. Goltra Tie Co., Buffalo, N. Y., and the following is an abstract of his discussion of the average life of railway ties.

The life of untreated railroad ties is variable and depends upon many factors, such as species of wood, size of tie, spacing, ballast, weight of rail, whether tie-plates are used, derailments, premature removals, locality where used, and other minor influences. An important factor not usually taken into account is the financial condition of the railroad upon which the tie is used. In general, untreated ties will last six to twenty years, and will have an average life of eight to ten years. It must be borne in mind, when calculating the average life of ties, that a good many are used in sidings, where they are made to last longer than in main tracks.

Treated ties in Europe, particularly on the French railways, have a longer average life than those treated in America, but it is believed that they do not obtain an average life of more than 22 years. In America we are approaching this record, and in some instances may have reached it. Some railroads are reporting such a low rate of tie renewals, and ascribing all the saving to tie treatment, that we are constrained to believe there is some error in the calculations.

With a knowledge of the percentage of treated and untreated ties in the tracks of any railroad, the average life of all of the ties can be determined closely. It is, therefore, easy to determine the quantity required for normal maintenance. If the quantity inserted falls below the annual requirements, the deficiency represents insufficient maintenance. As an illustration of tie mortality, the year the ties are put in the track is the starting point. The year in which the first ties fail is the first step. From this time on, the mortality will follow the curve of failure. The year in which the last tie is removed is the culmination.

Average life means useful life, for when a tie is removed for any cause, whether decay, mechanical destruction, reballasting or premature removal, it is dead. Its service is ended and it should be included with other failed ties in calculating the life of any group. Normally, the proportion of ties renewed on account of other causes than decay is small, although not negligible. It may run 5 per cent, but certainly should not exceed 10 per cent under any conceivable condition. Many ties classed as having failed from abrasion or mechanical wear really fail because of decay under the rail and around the spike holes. Frequently it is decay of the wood which induces rail cutting and spike killing of the tie. With the application of tie-plates this form of destruction can be minimized though not entirely eliminated.

It should be observed that the percentage of ties removed annually in each curve of failure increases in arithmetical progression in the first period (before the line of average life is reached) and decreases likewise in the second period (for ties lasting beyond the average life). That is a mathematical law, and the movement tends to follow it rather closely, although some ties may last for a longer or shorter period than the curves of failure would indicate.

The formulas upon which the curves and tables are based are as follows:

$$C = \frac{5}{3} L \qquad (1)$$

$$A + \frac{B - A}{2} = B - \frac{B - A}{2} = \frac{1}{2} S \qquad (2)$$

$$L = \frac{S}{100} \qquad (3)$$

C = Culmination, or the year the last tie of the group is removed.
L = Average life of group.
A = Sum of tie years, first period (below the average life).
B = Sum of tie years, second period (beyond the aver-average life).
S = Total tie years.

The formula (1), expressed verbally, means that the entire life of any group of ties is 1⅔ times the average life.

Reforestation in New York State

For the first time since the reforestation movement began in New York State the distribution of young trees from the Conservation Commission's nursery this year passed the 10,000,000 mark. At the close of the fall planting season there had been sent out 10,410,000 trees. Private land owners were the largest users, taking 5,000,000 trees, with industrial concerns second, taking over 2,000,000, and municipalities third, with slightly over 1,000,000. A total of 655,000 trees went to demonstration plantations, 361,000 to state institutions, and 527,000 for planting on state lands. A number of industrial concerns have established nurseries of their own and no longer depend upon the states to supply them with young trees; 2,000,000 trees were raised in this way bringing the state's total up to more than 12,000,000. For next year the city of Glens Falls has placed an order for 1,000,000 two-year-old white pine seedlings for planting in its municipal forest which was started in 1910 and now covers 1,300 acres and is the largest municipal forest in the state with the single exception of New York City's watershed forest around the Ashokan reservoir.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

CITY HALL, FLINT, MICH.

Flint, Mich.

COUNTY SEAT OF GENESEE COUNTY, 63 miles northwest of Detroit, 33 miles south of Saginaw and 65 miles east of Lansing. Flint is one of the rapidly growing automobile cities with good railroad connections, trunk line highways over which buses and interurbans radiate to all parts of the state. Manufacture of automobiles and accessories is the principal industry. Outside of the Detroit area it is the largest producer and example of mass production. Flint River, well bridged and at points built over, divides the city. Flint was laid out as a town in 1833 and chartered in 1855. Pop. 1925 (U. S. census est.) 135,000.

FAMED for its force account work, Flint, Mich., is included in this series as an example of a city just passing out of the upper limit of population. Distinctly a factory town making almost exclusively automobiles and accessories, the city is rapidly taking on the aspects and characteristics of the cities above the 100,000 class, i.e., business blocks of pretention are arising on the high-priced ground values, retail stores, bank buildings and clubs of size are replacing two and three-story elevatorless structures. Automatic traffic signals control whole streets and "safe" safety zones guard waiting street car patrons. Railroads are being removed from the center of town and plans for a viaduct over what remains of the river are being made to relieve congestion. Flint River winding through the center of the city, once the distinctive feature, becomes of less and less importance and is even covered completely with stores at one point. A small amount of power is still generated from the fall concentrated at a water-works dam in town, but in summer not much water passes this dam. Plans have been made and financing is under way providing for an additional supply above the city.

In consequence the office of the city engineer, H. C. McClure, is a busy place employing 700 or 800 men in the construction season and retaining about 150 key men during the winter. Last year's work included 200,000 yd. of paving, 25 miles of sewers, 27 miles of sidewalk, several bridges, a traffic control system and a swimming pool. Department "get-together" banquets are held at the beginning and at the close of the construction season. A monthly newspaper is published and many other things are done not ordinarily attempted by the usual small city engineering department.

Flint is a factory town and has been since early days growing naturally into automobile manufacture from the carriage and wagon work of the Dorts and Durants. It is a town of large factories, there being only a couple of dozen firms, hence everything is done en masse and on a large scale. This affects the engineer's work in that the plants have concentrated the population both as to living and working quarters. Further great housing schemes have been worked out for the Buick and Chevrolet employees in new subdivisions which are now coming under city control and require further public improvements. Of interest is the record of no strikes due, without doubt, to the success of the I. M. A. (Industrial Mutual Association) to which 30,000 factory employees belong at 15c. per week. The 10 per cent rebate to which members are entitled on certain things easily makes membership valuable even if the fine club house, benefits, summer resort and general welfare work carried on did not do so. The city engineer is interested for it is largely factory hands he must employ in the summer and it is desirable for them to find indoor work for the winter and be ready and fit, when spring comes, to re-enter the city's gangs.

Flint is located on the Flint River, 63 miles northwest of Detroit, 33 south of Saginaw and 65 east of Lansing, on the main line of the Grand Trunk R.R., for connections east and west and the Pere Marquette for north and south connections. Uninterrupted paved roads lead to the north, east, south and west. Buses and interurban lines ply the roads to all parts of the state. Perhaps half the area is yellow clay and the remainder with lighter soil is underlain with sand at 12 to 24-ft. depths. Machine trenching is feasible and practiced largely. In consequence of the subsurface conditions in some locations formations are not so easily found and tight sheetpiling is essential. Grades are nowhere more than 5 per cent but usually there is sufficient for sewer runoff and storm water drainage, which are carried by separate systems. A pumping station for sanitary sewage is under way and early next spring work will start on a sewage disposal plant.

Basic materials of construction, sand and gravel, must be obtained outside the city since that found locally is too small and too intimately mixed with clay. Hardwood lumber which originated the early vehicle manufacturing has, of course, long since disappeared.

Like many of the more stable automobile cities Flint's population had a hectic growth during the war and the high prosperity years since. At present the factories are running to or over capacity so that the city's facilities are taxed to the limit and improvements are asked for in greater amount than it is physically possible to care for them. The nature of the population requires economy of construction which the engineers are meeting by the direct-force-account methods. No one knows where the population curve will go. The count was 91,600 in the 1920 census, but a U. S. government estimate published a few days ago gives at present over 135,000. Mr. McClure states that he is endeavoring to get the city to have an official U. S. census which he feels would be worth all it costs from the publicity standpoint to say nothing of the engineering advantages in designing sewage disposal, water supply and other utilities.

Flint is governed by a mayor and twelve councilmen, two from each of six wards, each being elected in alternate years so that there are always six old members of the council. The city engineering department is the public works department and reports directly to the

mayor and council. Under the city engineer are divisions of construction, engineering, accounting, street cleaning, dirt streets and maintenance headed respectively by the first assistant city engineer, assistant engineer in charge of the office and design, a chief accountant, street cleaning superintendent, street commissioner and assistant engineer who directs the street and sewer maintenance. The first assistant who is the engineer in charge of the construction division directs a superintendent of sewers and another of paving. The city engineer is also engineer for the water department, planning board and other departments. In the office are seven to ten junior engineers on the drafting board plus an assistant engineer on sewer design who also secures rights-of-way. Six field parties of three men each are in the field and lay out the work for the construction crews. Two men handle the information desk. Seven clerks handle the accounting and Kardex file of stock. A garage and repair crew is maintained at the city yard where is also the municipal asphalt plant. All jobs are followed by a clean-up crew which puts the street back in its original or better condition, repairing or replacing paving and leveling lawns ready for seeding. On dirt streets it includes grading, guttering, installing tile cross drains and perhaps cindering sidewalks or streets.

All purchases are made on requisition approved by the city engineer and stock supplies are bought on blanket contracts made in January. Work orders are issued for everything and the crew foremen report back daily on 4x6-in. cards with the distribution of costs by code number. At least four men who are changed frequently check all final entries so that the chance of false entries on payrolls by collusion or errors in cost distribution are minimized to the limit.

Legislation for sewer and paving improvements is put through in the winter so that the work can be laid out systematically for the season. The jobs are then started in one end of the city and the crews work from one job to another across the city, no time being lost in long moves or in having equipment idle. Mr. McClure compared this procedure with that of the contractor who had to jump around on separate jobs and necessarily had much idle time for his equipment. He does not claim to do work any cheaper per unit than a contractor but such factors give a cheaper total in the year's work. The crews are continually pitted in rivalry against each other month by month. Last year three shovels operated during 599 pay days, one ditcher worked 153 days, another 167 days, with records on other construction equipment equally as good. Sidewalk crews are also in the race and during August averaged 840 ft. of 5-ft. walk per day each. All these records are printed in the monthly *Construction Log*, which has a circulation of 1,000.

Financing—Street improvements, sewers and paving, curb and gutter and sidewalk are paid for mainly by special assessment and are initiated by petition. The city pays 25 per cent of the cost of sanitary sewers, 100 per cent of storm drains and for the paving of intersections which is usually equivalent to from 15 to 20 per cent of the total. The city's share comes from general bonds with specific locations noted or from the budget appropriated from the direct taxes.

Paving—About 85 per cent of the paving is asphalt with practically all new work of this type, 1½-in. top, 1½-in. binder on 7 and 9-in. concrete bases. Of the total 420 miles of streets 126 are paved, all maintained in good condition with the exception of less than 5 miles, mostly old brick in the business district, rapidly being replaced.

The asphalt plant located at the city yards is in an area fast building up so that increased complaints required consideration of the dust-prevention nuisance. Last year a spray dust collector was designed and built. Through it the dust-laden air from points above the elevator, mixer and dryer are carried. The travel is 140 ft. past nozzles in a back-and-forth baffled chamber. Seven to twelve tons of dust are collected every day, dried and re-used with the fine material. The collector has solved dust problems. On the day the plant was visited housewives had hung out the family wash within 300 ft. of the plant and clear photographs could be obtained of any portion. An exhaust fan operated by a 15-hp. motor furnished the suction and a 3-in. centrifugal pump having a capacity of 300 gal. per minute the spray water under 80-lb. head. To eliminate any nuisance of smoke coke is burned under the kettles and oil under the locomotive crane.

The street car company paves its right-of-way 18 in. outside of the rails, usually with brick. The junction with the asphalt has never been continuously successful due to the vibration and disturbance of the brick. To cure this defect Mr. McClure uses a 3x3-in. angle with the leg sheared and bent down making 9-in. anchors into the concrete base at 12-in. intervals.

Flint is unusual and lucky in that it has never had street crossings elevated to meet cross walks. Curbs have a ½-in. batter. Mr. McClure says he does not like the appearance of the exaggerated batter that some cities use.

Sidewalks—A normal sidewalk program will run approximately 750,000 sq.ft. per season. A ¾-in. joint filled with asphalt is left between concrete curb and sidewalk. The latter is broken with expansion joints on 50-ft. lot lines. Sidewalks cost 19c. per sq.ft. This cost includes grading, engineering, overhead and all materials for a 4-in. two-course walk, using two barrels of cement per 100 sq.ft.

When a new pavement is opened in Flint a celebration occasionally takes the form of a dance on the clean surface, music being furnished by radios of adjacent houses all tuned in on the same station. Of course, the city fathers have a chance to open the street officially first.

Sewers—As noted above, machine trenches are used. In sandy material a shield in which the pipe is laid and jointed is dragged behind the bucket frame. Mechanical backfillers are used to refill the trench. Well points are used in wet material and at one point visited the machine had been used for the top cut of 6 ft. to quicksand and the sheetpiles had been jetted down another 6 ft. and the muck pumped out. Sod was laid in the bottom of the trench, the pipe laid and more sod wrapped over the joints.

In backfilling in clay it is the practice to flush the trench up to within 5 ft. of the surface, then let the rain flush or strike down from the top. Experience

Engineering Wor

Of the Small City

has indicated that capillarity will bring the water up about 2½ ft. and carry the surface water down to meet it. If more water is used the trench is unstable for a much longer time than when the above method is used.

Snow Removal—After a heavy fall of snow it is first plowed to the gutter. The street car safety loading zones are then cleaned. When the fall is in the evening, crews start at midnight to clean up the through streets and connections to country and highways. Twenty-six horse-drawn sidewalk V-plows start from the school houses as centers to serve the greatest number of students. Downtown several dumps into the river are provided.

Street Traffic—The parking problem in Flint is perhaps a bit more serious than in other towns of its size. Mr. McClure has cut down curbs on certain widely parked streets near the city hall and expects to fill the area between sidewalks and curb with gravel. This is cheaper parking space than widening the paved street and gives the parked cars a safer space.

The city engineer was called upon to design a street signal system which consists of a series of structural steel standards with cabin on top for the regulating officer. Lights show both at street level and on top of the cabin.

The Flint type of "safe" safety zone, which consists of a raised loading space in the pavement with a railing of 2-in. pipe and a heavy curb to fend off the automobiles as well as to keep pedestrians from leaving the zone promiscuously, has been recommended by the National Safety Council engineers as the ideal safety zone.

Garbage—Garbage is fed to hogs of a hardy variety obtained mostly from Minnesota. They are inoculated three times against cholera before being finally accepted. Ford trucks with four rectangular cans holding 15 cu.ft. each make individual collections of garbage. The cans are dumped into 5-ton trucks hauling two trailers to the farm, 6 to 7 miles from town. Collections are made every day downtown but only twice per week in residence districts in summer and once in winter.

Mr. McClure believes in keeping his men as well as himself up on all new improvements and every year persuades the Council to send five men to the Road Show in Chicago besides attending it himself at his own expense. Always he figures they have picked up ideas and purchased more efficient machinery which has saved the city many times the cost of the trips for the men. This year a 21-E mixer and other heavy machinery will be looked over most carefully. Particularly interested men are also sent to engineering, planning and other group meetings.

Reflections as to Flint's engineering cannot help but bring admiration. Every one in the staff is on his toes and reflects the hustle, co-operation and co-ordination of the principal industry the town lives on. When the season's work is over a banquet is held, not in a hotel but at the city yards, the men themselves decorating the garage and building the boxing ring where real manly sports provide the chief entertainment of the evening. No wonder when spring comes the city engineer's crews are sought again and again by the same men. The secret is that some one at the top has a personal interest in the human elements of the job.

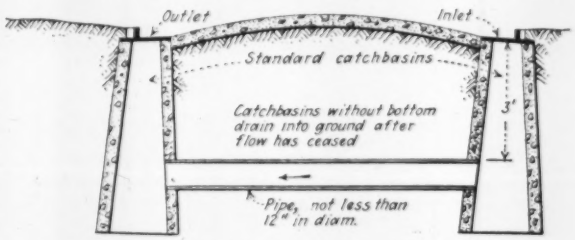
Underground Drains Eliminate Pavement Depressions

THE city of Beloit, Wis., has discarded both covered and open gutters for carrying drainage across a street intersection where storm sewers are not available. Instead, the underground drain shown in the accompanying sketch is used.

A standard catchbasin is placed in the curb on each side and a pipe not less than 12 in. in diameter is laid to drain from one to the other, with 6 ft. of cover.

The water coming down into the gutters flows into the higher intake, crosses underground to the lower catchbasin and then overflows through the grating into the gutter again. The surface of the intake grating is kept at least 6 in. higher than the one that serves as an outlet. If at some future time a storm sewer is laid on this street it may be laid back of the curb line and the catchbasin connected into it.

While not suitable for use in clay soils and in nowise



SECTION THROUGH UNDERGROUND DRAIN

replacing a complete storm-sewer system, these underground drains have been found more satisfactory in all kinds of weather than either open or covered gutters. One of the principal features is that the undesirable depression which an open gutter across a curb intersection leaves and which requires especial care during construciton for a smooth road surface is eliminated.

The information contained in this article is taken from a recent issue of the *Concrete Highway Magazine*.

New Sewage-Works of Stellenbosch, Africa

Primary and secondary screens, square Dortmund tanks, separate sludge digestion, and automatic dosing chambers with filter beds for final treatment, comprise the new sewage-works of Stellenbosch, South Africa, according to a paper on the municipal undertakings of that place by E. J. Hamlin, town engineer, read before the African District of the Institution (British) of Municipal and County Engineers, reported in *South African Engineering* for November, 1925. Each of the four filter beds is 90 ft. in diameter and has a slightly dished surface, the depth of stone being 6 ft. at the rim and 5 ft. in the center. The walls and bottoms are of concrete. On false floors of aerating tiles is placed 2-in. granite, 18 in. deep at the edges and 12 in. at the center, and above this is 4 ft. of 1-in. stone. Using three beds at a time, 106 U. S. gal. of tank effluent per 1 cu.yd. of stone will be treated. The intention is that each bed will be dosed for three days, then rested for one day. Screenings are to be buried. The works are being built after plans by Mr. Hamlin, except that the sludge digestion tanks have been made smaller, as advised by John D. Watson, consulting engineer, Birmingham, England, who reported on the project.

Land Settlement Widely Supported in Reclamation Conference

Policy of Planned Colonization Endorsed by Varied Interests at Gathering of State, Congressional and Railroad Leaders—Problems of Existing and New Projects—Skilled Farm Immigration Advocated

STRONG ENDORSEMENT of planned settlement as an integral part of land development was voiced at a conference on reclamation and land settlement, held at Washington, on Dec. 14 and 15, at the call of the Bureau of Reclamation of the Interior Department. Addresses were made by two Cabinet secretaries, a number of members of the House and of the Senate, railroad representatives, officials of Western states, agricultural college men, and others. With few exceptions they expressed their belief that successful agricultural development of vacant or partly vacant land can be accomplished only through community development, selection of settlers, low-interest financing of farm development, and study of the special agricultural problems of the individual region or project.

Other outstanding features of the proceedings were the authoritative statement that the country is suffering from agricultural overproduction, followed by emphatic dissent from this view; colorful pleas by Western men for continued reclamation of arid lands with federal money, regardless of the economic feasibility of the projects; and divergent views on whether the financing and supervision of settlement should be carried out by the states or by the federal government. No attention was given to discussing the cost limits and other conditions which determine the feasibility or infeasibility of proposed projects. Immigration restrictions were injected into the discussion by the well-known North Carolina colonizer, Hugh MacRae, who argued for admitting skilled European farmers.

Views of Cabinet Secretaries—Hubert Work, Secretary of the Interior, opened the conference with the remark that for the first time the Interior and Agriculture departments are co-operating effectively. The mere reclaiming of small areas of land in a few states is not a matter of national concern, he said, but the federal interest in reclamation arises from its status as part of the general problem of conservation of agricultural land throughout the country. The low percentages of cropped land in the Northeastern and Southern Atlantic states suggest that land reclamation in the East be invited, which is further favored by the nearness of markets. However, if Congress follows up its authorizing action of last year by appropriating $100,000 for the investigation of reclamation possibilities in the South, the money will be used only for co-operative investigations and will not be spent on small-scale colonization experiments.

The Secretary of Agriculture, W. M. Jardine, declared that the present perplexing problems in farming and reclamation grow out of overproduction, and asked that the questions before the conference be examined on the basis of facts and not from the standpoint of encouraging land ownership or of cultivating the pioneer spirit. Even now agricultural expansion is going on, especially in the region of the Great Plains, faster than warranted by the demand for agricultural products. Extensive reclamation at this time is therefore inopportune. Some of the problems of agriculture in the West may be aided in solution by internal-waterway development. Industrial growth in the farming regions is desirable to balance the agricultural development. In summary, he declared, a wise reclamation policy must be based on a careful survey of demand; an unwise policy will tend to destroy the agricultural balance that is now working itself out.

Congressional Opinions—Leading addresses were made by Representative Louis C. Cramton, of Michigan, chairman of the interior department appropriations subcommittee of the House, and John B. Kendrick, Senator from Wyoming, author of a bill introduced in the last Congress providing for federal settlement units on new reclamation projects; Addison T. Smith, of Idaho, chairman of the irrigation committee of the House; E. O. Leatherwood, of Utah; Scott Leavitt, of Montana; Charles E. Winter, of Wyoming, and C. B. Hudspeth, of Texas.

Congressman Cramton asserted that the government is not likely to appropriate federal funds to reclaim swamp and cutover lands in the Southeast until the ability of its departments to handle the first great experiment in land reclamation is demonstrated. He expressed strong doubt as to whether agricultural overproduction is the trouble with reclamation. Declaring agriculture to be the bulwark of our national institution, he said that nevertheless it must not be fostered by doles from the treasury, but must be dealt with as a business proposition.

After paying his respects to the Western argument that Michigan has no concern with how the reclamation fund is spent in the West, he proceeded to list three important lessons to be drawn from our years of reclamation experience: First, that merit rather than politics ought to designate the reclamation projects; second, that the selection of competent farmers as settlers is necessary for sound development; and, third, that we need state and local co-operation in reclamation development. More than one state has passively worked against the interests of reclamation projects within its borders, instead of aiding.

Pioneering can never be made easy, said Mr. Cramton, but it can be made possible of success, by applying right methods. "Heaven forbid that there be any more of these loans without interest." Referring specifically to the Kittitas project, in Washington, where work has come to a halt because the state refuses to take up the burden of settlement and settlers' aid, he said that provision of settlers' credit by a private corporation, as recently proposed there, has some advantages but that the general arguments favor putting the responsibility on the state. Finally, voicing a demand that the confidence of Congress in reclamation be re-established, he said that this can only be done by showing a balance sheet that pays. At present only two projects are in hopeless condition, while the others will recover as soon as the people there understand that the Administration

and Congress mean business regarding repayments.

Senator Kendrick pleaded that reclamation be not delayed, as it meets not only a national but a grave local need, for upbuilding of the Western commonwealth. He urged that two specific projects in Wyoming be undertaken at once. He strongly opposed state co-operation in reclamation (by undertaking settlement and settlers' aid) as required by the last Congress, and instead argued for settlement and aid by the Bureau of Reclamation itself, as provided in the Kendrick Bill introduced in Congress last year.

Congressman Addison T. Smith, of Idaho, declared that talk of overproduction is absurd. He said that the reclamation fund does revolve, and that reclamation has paid the country well, despite a loss to the government of 20 to 30 million dollars. The results obtained warrant continuing the reclamation policy and entering into the construction of new projects even if estimates of cost and production show them economically infeasible. Strong declamations against state aid and in favor of postponement of collection of the settlers' debts, coupled with demands for additional reclamation, were made by several Western congressmen, in particular Charles E. Winter, of Wyoming. On the other hand, Congressman Hudspeth, of Texas, declared emphatically against moratoria and debt deferments, and championed the principle that no additional reclamation project shall be built unless it is shown beyond question that it will pay. He demanded that all the Western states demonstrate unequivocally that they are responsible and sound in their business attitude by full and prompt payment of reclamation debts.

Directed Settlement—Principles of settlement derived from experience in the growth of the federal reclamation projects were set forth by Prof. David Weeks, of the California College of Agriculture. Official figures show that on the federal projects water is supplied to about 3,000,000 acres of land, comprising about 36,000 farms, of which 6,000 still require settlers and 11,500 are farmed by tenants. Farm development is retarded when the individual resources of the settler are not aided by community machinery, counsel, and financing. Among the principles which he outlined are: That settlers must be qualified, that the project must be made attractive to competent settlers by planned development, that land speculation must be eliminated by control of land sale prices, that land quality should be recognized as a factor in the planning, that a low-interest system of financing the farm development is essential, that financial safety makes it necessary to safeguard such financing by co-operative control of the settlers' expenditures and operations and by agricultural advice and direction, and that the financial and management policy must be sufficiently flexible to allow for inevitable fluctuation in business and agricultural conditions. In applying these principles, however, he holds that care should be taken to maintain a spirit of self-government. Based on actual cases, Professor Weeks computed the cash capital requirements of settlers on irrigated lands at $7,000 to $8,000, exclusive of land cost.

Bringing out the railway point of view, E. P. Benson, of the Northern Pacific R.R., said that in his experience "you have got to take a man under your wing and got to root him in the soil until he gets established." The business value of successful settlement to a railroad whose line serves the settled territory is illustrated by the fact that every ewe on the Flathead project represents $1.50 annual freight income to the railroad for lambs shipped to Chicago. V. Kuska, of the Chicago, Burlington & Quincy, urged that the cost of land and water rights on a project to be opened be determined as early as possible, as the colonization man cannot work successfully without knowing this cost. R. A. Smith, Union Pacific, expressed himself as wholly in accord with Secretary Jardine on overproduction of irrigation land, and declared that we should not go ahead with new reclamation units for at least five years. J. L. Cobbs, Atlantic Coast Line, brought out the need for an inventory of developable agricultural resources in the South Atlantic States. He said that the soil there is now fully as good as it ever was, despite the exodus from the region a hundred years ago in favor of the frontier regions then just opening up. J. F. Jackson, Central Ry. of Georgia, announced that his road will not resume advertising land in its area until a full survey, now being carried out by the state, shows definitely what the resources and development possibilities of the region are, and until they are able to make sure that the settler can succeed. He expressed the belief that none but community settlement can make a success.

In a conference of Western and Southern railway representatives called to harmonize the conflicting views and demands of the two sections of the country, agreement was reached on two conclusions, (1) that the Interior Department should adopt a definite policy in regard to the terms of payment for all Western reclamation projects, and that the expressed policy of the Secretary of the Interior and the Commissioner of Reclamation to put reclamation on a business basis is sound; (2) if and when the sum of $100,000 becomes available to the Department of the Interior for investigation of land possibilities in the South, such investigation should be undertaken promptly.

Dr. A. M. Soule, of the Georgia College of Agriculture, said that a survey of Georgia for soil and crop possibilities has been completed, and the authorities are ready for advising any one on best procedure in development or settlement.

Reclamation Experience—Dr. Elwood Mead, Commissioner of Reclamation, opened a discussion of reclamation experience by an address "Aided and Directed Settlement," illustrated by motion pictures which brought to view particularly large-scale methods of land leveling, and types of farm and farmhouse development in the West. Large-scale land leveling was undertaken by the Bureau of Reclamation only once, under special authorization of Congress, on a languishing project; when once leveled and cultivated on a large-scale plan with extensive use of power equipment the land stayed in cultivation.

Dr. John A. Widtsoe, member of the Fact-Finding Commission two years ago, made a brilliant address under the title "Smoothing the Path of Colonization." Experience of the two great events of colonization in our history—the settlement work of the Utah pioneers in 1847, continued to the present time and the government's enterprise under the Reclamation Act—establishes the principles on which we may build the future of colonization, among them these: (1) The farm must be able to yield a living of the same grade as city living; (2) settlers must be selected for ability, not mere love

of land; (3) the settlers must organize, as community action is essential under modern conditions; (4) both technical and financial aid must be given the settlers, if they are to be permanent.

Ex-Governor Thomas E. Campbell, of Arizona, also a former member of the Fact-Finding Commission, presented some significant facts. Referring to the three crops of settlers on irrigation projects, so often spoken of, he said that 65 per cent of the original settlers are still there. As to unskilled farmers: On all the reclamation projects, 73 per cent of the farmers had previous farming knowledge, and on the most successful projects even a larger proportion, up to 90 and 94 per cent. As to overproduction of irrigation crops: In gross production the federal reclamation projects form only 1 per cent of the country's total agriculture, and much of their output does not compete with that of the humid regions; therefore a small increase in reclaimed acreage can hardly affect the market status of crops. As to intensive production: Four projects in the Southwest represent one-third of the area of federal reclamation projects, but yield more than half the total production. Their average gross yield per acre in the last five years was $94, whereas the average of all the other federal projects was $40. Wherever production per acre is found to be low, the project is poor in all respects; one of the notably poor ones has a gross production of only $15. Finally, referring to the fact that the work done by the fact finders and by the boards of review and adjustment during the last two years is little different from work done as much as 10 years ago by previous boards of review, which saw the same things that are seen and discussed today, he said that we will continue to wiggle and wobble along unless the vision that controls both policies and methods sees 50 years ahead.

"Problems of Settlement of Abandoned and Unoccupied Lands on Existing Federal Irrigation Projects" was the subject discussed by George C. Kreutzer, director of reclamation economics in the Bureau of Reclamation. He said that of the existing projects, one-third are in good shape, one-third in fair shape and one-third in poor shape. One project in the latter group, having ample water, ample storage, fertile soil, a good northern climate, and a low cost ($45), is far behind in its payments to the government, has not nearly enough settlers although 17 years old, and has only 31 per cent of its farms occupied by owners. This project is at the parting of the ways; if abandoned, it will revert to dry farming, with large loss to the government and to the private owners. He recommended that the government should have the power to buy up delinquent property when foreclosed, in order to save its investment. Such property might then be improved, preferably in large tracts, and sold to settlers attracted by the improvements, and selected and aided. If this plan could be applied to a 9,000-acre tract on the project in question, which is nearly all abandoned, a selected group of 100 or even 50 farmers would probably have the effect of virtually reclaiming the project. On another project, of 48,000 acres, settled since 1908, only 14,000 acres are irrigated. Competent settlers, with a sound program of improvement, could reclaim such projects, but it is not possible to sell rundown farms. The government must sell farming opportunities, not merely land and water.

On one point of the subject here discussed, whether it is better to leave the work of the improvement to the individual farmer or make improvements for him, Dr. Elwood Mead said that the two methods were tried in comparison on one irrigation project. Improving the farms cost $100 per acre. Every improved farm was sold in a short time, but the unimproved farms, offered at $100 per acre less, did not have a buyer. The opportunity must be made obvious to the settler.

Western State Views—Frank C. Emerson, state engineer of Wyoming, after heartily endorsing land settlement principles, referred to the exploitation of the Western states through public land sales and leases, and urged the right of the West to have the money so produced spent within its area. He took issue with the view that there should be no additional reclamation at the present time, and referred to a fine project in Wyoming, in a county which has been the largest contributor to the reclamation fund and which now, where oil production is past its peak, will go downhill unless the reclamation project is built at once. Prof. E. B. House, of the Colorado College of Agriculture, opposing the attitude sometimes taken that farming should be regarded as a mode of living rather than as a profit-making business, said that it is a business, and a good one, in spite of the common complaint of farmers that they are losing money each year.

Rhea Luper, state engineer of Oregon, asserted that his state has shown its faith in reclamation, but cannot and will not go further. Aid in settlement is not proper work of the state. Support has been given to irrigation development by a state bond guarantee act, under which a number of projects have been developed. All of these projects would have been in a much more favorable position if they had been undertaken by the federal reclamation service under the present repayment law. In federal reclamation, however, the citizens feel that it is only their own money that is being spent by the government, and are not willing to contribute tax money to furnish financial aid to the settlers.

Financing the Farmer—John H. Guill, of the Federal Farm Loan Board, described the extent and effectiveness of the work of the land banks. They have forced down the loan rates of private banks and money lenders and "have practically driven usury from the field," saving the farmers more than $80,000,000 per year in interest and commissions. On the other hand, the intermediate credit banks have not yet been perfected, though they are progressing. Discussion brought out that the land banks are not of service for financing of land settlement, and that this purpose requires another system, of the building-loan type.

Southern Problems—Hugh MacRae of Wilmington, N. C., dealt with the land settlement problems of the South. He referred to the extensive degradation and virtual abandonment of land formerly farmed to high productiveness and still as rich agriculturally as it ever was, largely because of tenant farming, which "is a short cut to impoverishment of the land, of the tenant, of the owner and of the nation." In part this is due to the characteristics of the negro farmer, who is of the poorest type as a tenant, and yet produces 75 per cent of the cotton of the South. New types of farming must be introduced to improve this situation and to reclaim unused and abandoned land. This can only be done through systematic settlement and through the cultiva-

tion of an independent owner-farming system. It will not do to take failed farmers for such settlement nor an exploited wheat farmer to make an exploited cotton or tobacco farmer; exploitation is at an end as a successful agricultural system. Scientific colonization has the difficulty that if corporations try it for profit, the settlers will fail, and if they try it altruistically, the corporations themselves will fail. Hence the governmental obligation. Mr. MacRae drew a graphic picture of the situation existing with regard to skilled farmer immigration from abroad. The success of development of high-productivity farming in Southern land settlement is dependent on obtaining small groups of skilled European farmers, preferably from Denmark and Holland, to form the core and model of the farming community. The quota immigration law, with its preferential provisions and its time feature, makes farmer immigration substantially impossible, however. A farm immigration bill was passed by one branch of Congress at the last session, but was so modified in the other branch as to become ineffective.

Agricultural development problems of the South were also discussed by Dr. W. W. Long of Clemson College of Agriculture, South Carolina, Dr. A. M. Soule of Georgia College of Agriculture, and others.

Reclamation in Palestine was dealt with by Emanuel Neumann, secretary of the Palestine Foundation Fund, who presented many statistical facts on the extension of agriculture in Palestine but did not detail the settlement methods applied.

Half of Lowell Service Pipes Changed Within 52 Years

By Robert J. Thomas
Water-Works Engineer, Lowell, Mass.

ACTIVE water has led to many changes in the material used for service pipe in the water-works of Lowell, Mass. Almost exactly half of the 15,695 service pipes put down have been changed to one or another material than that originally used since 1873, the first full year of operation after the works were built. The main changes have been due to (1) the corrosive attacks of the original infiltrated and river supplies on wrought-iron pipe; (2) the action of the later driven-well supplies on lead and lead-lined wrought-iron pipe, which caused lead poisoning; and (3) leaks in tin-lined wrought-iron pipe used in place of lead-lined. At present, although 289,521 ft. of plain wrought-iron service pipe has been laid only 120,482 ft. of it is in use. Lead now predominates, with a total of 210,699 ft., besides which there are 45,382 ft. of lead-lined wrought-iron and 100,952 ft. of tin-lined. Adding to the 120,482 ft. of plain wrought iron pipe the 143,205 ft. of galvanized iron in use gives 263,687 of these two against 357,033 of lead, lead-lined and tin-lined. The wrought-iron pipe was built under specifications calling for that material, marked either "Byers" or "Reading" and pipe so marked were obtained.

Of 15,695 service connections totaling 628,386 ft. laid from 1873 to 1925 inclusive, 7,859 have been changed from one material to another (see table).

From 1873 to 1883 wrought-iron pipe was the material used. Some of it was cement lined, some tar coated and more of it was rubber treated. Ten years' use, however, showed it to be unsatisfactory on account of corrosion. In 1884 some of these wrought-iron services were replaced with lead. This material proved satisfactory until 1899, when it became known that water from the Cook well system, introduced in 1893 acted upon lead, causing lead poisoning. For a few years previous to this time some lead-lined iron pipe was being used on account of its lower price but there was the same objection to it as to lead pipe. Tin-lined iron pipe was introduced and wrought-iron pipe came back into use. The tin-lined pipe proved to be very troublesome, leaks became very common with it and the Water Department was forced to replace it with iron. In 1901-2 when use of the Cook well water was discontinued, lead-lined pipe came back into use for a couple of years. For the last ten years galvanized iron has been laid. Not much confidence is felt in the durability of this material. A little of it has already been renewed (see table). Lead pipe has proved the most durable and there is more of it in use today than of any other. If the carbonic acid was removed from the Cook and hydraulic well water, lead pipe would be as good as brass and cost less. The cost of replacing the 210,699 ft. of lead service pipe now laid, probably $1 per ft., can and should be avoided. The replacement of other materials used up to date must be met within a few years, especially where new permanent street paving is about to be constructed.

Before the iron-removal plant was put in use services of all material, including lead, were clogged by the iron in water, combined with crenothrix. This trouble stopped after the iron-removal plant went into use.

WATER SERVICES LAID AT LOWELL, MASS., 1873 TO 1925

Material	New Services Ft.	Changed to Ft.	Changed From Ft.
Iron	289,521	18,673	187,712
Lead	129,879	93,126	12,306
Lead-lined iron	34,010	13,474	2,102
Tin-lined iron	84,600	44,272	27,920
Galvanized iron	90,376	53,955	1,156
Total	628,386	233,500	231,166

New services laid totaled 15,695, of which 7,859 were afterwards replaced by material different from the original. Altogether 1,121 of the services have been cut off at the main, but of these 108 have been restored. This makes a net loss of 1,013 service connections and leaves 14,682 in use at present.

St. Paul Water Consumption and Costs in 1924

During 1924, St. Paul consumers of water used 76.9 gal. per day or 266 gal. per tap and 293 gal. per meter—for domestic meters the average daily consumption was 141 gal., and for manufacturing uses the average per meter was 4,773 gal.—according to the last annual report of J. W. Kelsey, general superintendent and engineer. The cost of supplying water for maintenance alone was $57.37 per million gallons. If interest on bonds and sinking funds is added the figure rises to $103.35. As ground water is easily obtained the city supplies only about 60 per cent of total water consumed, but the 40 per cent is principally used by large consumers. St. Paul is completely metered and is contemplating the installation of sliding scale rates and an increase in revenue. The operating income increased last year 4 per cent but the fixed charges on bonded indebtedness increased 17 per cent.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

The Construction Division; Some Problems and Possibilities

Sir—The Board of Direction of the American Society of Civil Engineers at its Montreal meeting last October authorized the formation of an additional technical division of the Society to be known as the Construction Division. This action was taken owing to the desire of a number of members to arouse a more active interest in the affairs of the society by those members actively engaged in construction engineering, as well as to fill a real need in the profession. The new section is to be initiated at the time of the annual meeting of the society in New York, in January.

The recognition of the Board of Direction in authorizing the division is appreciated. It is believed that civil engineers will progress faster and farther when all branches of the profession shoulder their responsibilities. The history of the construction industry indicates that there is a constantly growing opportunity for civil engineers in the field of construction. The increasing size of projects with their multiplicity of problems all tend in this direction.

Civil engineers have been accused of not using their best endeavors to eliminate all possible waste in their particular field. Although new materials and economies in design have made the modern engineering structures the marvel of the modern world, there are similar numerous possibilities in the construction end of public and private works.

The awakening of a keener scientific spirit and attitude of mind, together with the introduction of new machines and methods indicate these great possibilities. Special attention might well be directed to simplification of manufactured products, to reduction of daily and seasonal unemployment, to engineering studies of efficiency and to adoption of economical practices.

There seems to be a vital need for standardization in construction. Engineering Foundation and the National Research Council, while leading in their particular fields, indicate the need of construction engineers' studying their own special problems.

It would seem worth while to attempt to define construction terms. For example, definition of soils (i. e., quicksand, earth, loose and solid rock) has been left to the ingenuity of local engineers, owing to the lack of national definitions. Standardization of measurement of sizes, mixtures and units of measurements of temporary and permanent work in place opens large opportunities for real usefulness. National standardization of machine capacity can encourage stock production by manufacturers with concurrent reduction in costs. There is need for standardization of workmanship (with a range of variations) as well as standards of quality. Class A, B, and C brickwork, carpentry and masonry have rarely been defined and yet are essential in preparing specifications and making appraisals. For want of such classification, specifications today are merely general when they stipulate that "materials and workmanship shall be first-class." Further, due to the lack of the establishment of standards, construction cost analyses are rarely made in man-hours or machine-hours.

When engineers can meet on a common ground and discuss and clarify their joint problems, beneficial results are sure to be obtained. Today designing engineers in preparing their specifications are frequently tempted to not only specify results which they desire, but, unconsciously perhaps, stipulate also methods of accomplishing these results as well. Such stipulations make for misunderstandings and even conflicts on projects in the field. It is rarely desirable or justifiable for an engineer to specify materials and methods, and then require a guarantee of results for a term of years by constructors. Harmony tends to create pleasure in work. Co-operation tends to create mutual respect, as well as to increase the self-respect of all parties.

No one appreciates more than does the construction engineer the advances in the art and the necessity for progress. Frequently, however, the designing engineer is apt to become very enthusiastic regarding certain pet theories without regard to their practicability in the field. Recognition by both parties of their respective problems through conference and better understanding can make for more rapid and permanent gains in technic. When designing engineers clearly state their reasons for certain requirements and the objects to be gained thereby, without too many frills and refinements as to field practices, they will be met and attained with right good will on the part of constructors. Proper allowances should be permitted for field and weather conditions, materials available in market and accuracy in fabricating shops. A common purpose tends to encourage good workmanship.

At meetings of the American Society of Civil Engineers, construction engineering topics would naturally be in distinct contrast to the labor matters, business policies or civic programs featured by other national construction groups, and discussion would be limited to the technical features. It is timely to amalgamate the entire membership of the society by the discussion of all phases of civil engineering problems, including design, finance, construction, operation and maintenance of works and structures.

A great deal of discussion of recent years has taken place as to the need of construction courses in our colleges. Only one or two universities now offer them. The members of the Construction Division can properly urge the inclusion of such studies by their local universities, and perhaps offer to assist the college professors, when requested, by giving class lectures. Students can frequently be assisted on their thesis work in securing data on actual construction projects and in opening field laboratories. These young men can also be encouraged by actual employment during summer vacations, in order to enable them to secure actual field experience during their college years. To be consistent, the young graduate should then be offered employment in order to justify his selecting construction engineering courses and should be given a chance to "make good."

Much encouragement can also be given by construction engineers through their own division to research work, both in the laboratory and on field construction work itself through proper co-operation. This research work should be co-ordinated throughout the country. Assistance should also be given to manufacturers in their work of simplification and production of new equipment and materials.

A. P. GREENSFELDER,
Secretary, Fruin-Colnon Contracting Co.

St. Louis, Mo.,
Dec. 7, 1925.

The Cost of Submitting Estimates

Sir—We feel that the cost of estimating is becoming too great a financial burden on the reputable contractor who submits intelligent estimates and that the architects are not always frank with contractors from whom they secure estimates.

During the last year in this locality we have knowledge of several projects, some of them running over $300,000, for which architects asked estimates and in some cases were quite insistent not only in regard to getting estimates but allowing very little time to compile these estimates. These estimates were secured for apparently no other reason than to find out what the cost of the project would be and as in all cases the figures ran over the expected expenditure, the projects were abandoned or extensive revisions were necessary, although six or eight contractors had spent considerable time and expense in compiling these estimates with the result that the only ones benefited were the owners who found out the cost, and the architects who probably were able to collect a certain percentage of their fee. To obtain something for nothing is not equitable.

We also have a case in mind where we were one of a selected list of firms requested to figure on a building costing about $250,000. We deposited with the architects the sum of $15 for plans and specifications. The estimates ran over the appropriation and we were asked to revise our estimate. In order to facilitate matters we secured from the architect an additional set of plans which had been used

by some contractor in compiling the first estimate, for which we again deposited $15. On the revisions a few selected contractors were asked to make their own suggestions how the cost could be decreased and still retain the original exterior design and floor areas. This entailed considerable time and expense and we figure that this estimate cost us about $500. We did not receive the contract and on returning the two sets of plans and specifications for which we had deposited $30 we received a check for $30 less $11 for cost of blueprints.

We feel that this was rubbing it in and that if the architects cannot afford to supply plans for estimating, the owners should bear the cost. On projects other than public work the owner gets the benefit of competitive bidding, why should not the contractor who makes up his estimates be reimbursed? If the owners paid, say, even two-tenths of one per cent for each estimate, more care would be taken in selecting the bidders and the estimates would come in much more intelligently and would eliminate a great deal of the guessing which now enters into estimates.

We would be glad to know what other contractors have to say in regard to this matter.

White Plains, N. Y., FRANK N. GOBLE, INC.
Dec. 8, 1925.

T-Branches Rather Than Y's for Sanitary Sewer Connections

Sir—The recently promulgated rules and regulations of the New Jersey Department of Health preclude the use of T-branches on sanitary sewers excepting in special instances. A discussion of the soundness of this rule should be of interest. The practice of the writer's office for the past thirty years calls for the use of T-branches instead of Y's, and no case has been reported to him indicating this practice to be unsatisfactory. At first thought it might appear that Y-branches are to be preferred because of the convergence of two streams of sewage in the same general direction instead of at right angles. The theoretic advantage of the Y, however, by no means offsets the practical value of the T.

In the construction of a system of sewers, especially with machine digging, it is more convenient and involves less lost motion to construct a sewer up one street and down the other. It is more practical to lay the pipe with bell ends away from the completed sewer. Only in cases where grades are so steep that the creep of the pipe would be a factor is it necessary to lay the pipes from the lower to the higher level. The use of the Y-branch precludes the possibility of laying sewers with the bell end down grade for the simple reason that the flow from the house connection would be adverse to that in the sewer.

By the use of T-branches, special curves and bends are unnecessary. The importance of this is obvious when we consider the difficulty of supporting the short specials in a newly made sewer trench. When the time comes to make connections to the sewer, T's can be located more accurately than Y's.

It is not practical to insert branches for all possible future connections as the sewer is built. It will become necessary, therefore, from time to time to tap the main for additional connections. Under these conditions T-connections can be be made more readily than Y's. With use of a short section of pipe, specially made, consisting of a bell and just sufficient length of the barrel of the pipe to pass through the wall of the main sewer, positive assurance can be had that there will be no projection in the sewer to cause obstructions. These special fittings can be ordered from the factory in advance and kept in stock. Should Y-branch connections be used, the tapping of the pipe and the insertion of a proper fitting to insure freedom from projections into the sewer is attended with much greater difficulty.

The theoretic advantage of the Y-branch which apparently causes the flow from the house connection to enter in the same general direction as the flow of the sewer rather than at right angles as is the case when T's are used is not so important as might be assumed. In the majority of cases the branch is so placed that the flow line of the T- or Y-branch is above the springing line of the sewer, and flow of the sewage in the main rarely rises to the springing line. The flow from the house connection therefore enters the sewer with a vertical drop with a Y or T.

While the subject herein discussed is one of the minor points in sewer construction it is the opinion of the writer that it is of sufficient importance to call for a general discussion from all interested in sewer construction.

New York City, ALEXANDER POTTER,
Nov. 27, 1925. Consulting Engineer.

A New Point in Cold Weather Concreting

Sir—The collapse of the John Evans Hotel, described in your issue of Nov. 12, 1925, p. 800, seems difficult to account for on the supposition that concrete cures or increases in strength uniformly. It is on the contrary readily accounted for by the phenomenon of sweating during a rise of temperature of concrete which has been chilled during the early stages of curing.

The history of reinforced concrete shows that by far the greater number of failures due to premature removal of the forms has taken place in the fall and spring seasons when the average contractor is likely to suppose that the concrete does not need heating. When the temperature is 40 deg. above zero the concrete may be readily chilled at night by a drop to or about the freezing point. It does not need to freeze but only to get thoroughly chilled in the earlier stages of setting. Then it may appear to be fairly hard, yet nevertheless will soften and sweat during a sharp rise in temperature at some subsequent period from three to five weeks after casting, accompanied by a very marked decrease in shearing resistance and some reduction in its compressive strength.

About eighteen years ago I designed a four-story wholesale building. Inspecting the work on the first two stories I was satisfied that my contractor client had a first-class foreman and thought no more of it until I received a call from the contractor during the fall stating that there was trouble with the building and the columns seemed to be punching into each other. It looked rather unreasonable to me so I told him that was a new phenomenon and I would be up there the first thing in the morning.

Arriving at the building, I found to my surprise that from the second floor to the roof they had been operating with one set of forms; that the foreman whom I had expected to complete the job had met with an accident and broken his leg, and the new man taking his place had centered the roof from the fourth floor and had placed a heavy cinder fill on the roof. This carried the load very nicely for about ten days until the concrete commenced to sweat during a rise in temperature of some thirty-odd degrees. Then things commenced to happen. As the concrete softened and its strength decreased in shear at one point the slab sheared through clear around the column head. It was held up by the mushroom spider. On arriving at the job I immediately had shores put in under each of the slabs, supporting the fourth floor from the third, but before we had it fully supported the slab sheared through around two other columns but it still carried the weight. Of course, the drop of the third floor slabs, although they came down practically without bending, only shearing through about the column, left the roof, which was soft, that much out of line. At mid-day the concrete that was broken through could be cut out with a chisel without striking a blow other than just chopping it out with a hand cold chisel.

A ring about 8 in. wide was cut around the column head and back about 18 in., removing the concrete that was broken through, and the opening thus made was filled with hot 1:1½ grout. The building is in use today carrying 250 lb. per sq.ft. of floor. While the under side of the ceiling does not make a very artistic appearance it is doing service.

The danger of chilling during the spring and fall season in the initial stages of curing concrete is not generally understood either by the engineering or the contracting fraternity. Softening of the concrete during the sweating period three to six weeks subsequent to casting when the cement has been chilled in the early stages of curing is very common indeed. Slabs and beams get out of shape and, hardening later, develop working resistances substantially equivalent to those that have not been distorted. They may even develop a greater degree of strength if the finish coat is put on subsequent to the sweating and sagging because of the added material required to level up the work.

The only safe way to secure reinforced-concrete work which will keep its alignment is to see that the concrete

gets into place hot in chilly weather, and is protected from being chilled for the first two or three days. This may be done at the insignificant expense of heating the water, and concrete mixed with hot water not exceeding 140 to 150 deg. temperature will in general be stronger than concrete mixed with cold water and given ample time to cure. Heating the water eliminates the surface tension and makes a more uniform mixture of the cement, water and sand.

The old-fashioned mushroom head did much to make the Turner flat slab fool-proof. It did not prevent, however, the same occurrence of bad judgment which caused many failures and loss of life with less conservative types of construction. Had the flat slab in the Evans Hotel followed the details in respect to the head embodied in the earlier types it might have been out of shape but it would unquestionably have been standing today, notwithstanding the lack of conservative procedure in failure to heat the water thoroughly and get the concrete in hot in casting the first floor.

Minneapolis, Minn., C. A. P. TURNER.
Nov. 17, 1925.

The Proper Construction of Pipe Sewers

Sir—The letter from H. A. Seydenbach of Tartu, Esthonia, in your issue of Nov. 19, p. 850 is interesting as showing that the principles of true pipe laying are well understood in a country which we are too apt to think is not as advanced in the details of construction as the North American continent. I am quite prepared to admit that sewer construction carried out as he describes will secure a thoroughly sound sewer, but it is not likely to be done in that way on this continent, and to do so would cost more than to use concrete as I advocated.

I have just received a letter from the office of the municipal engineer of Singapore, in which the writer supports my contentions, as expressed in my article in your paper, and states that "it has long been the practice in Singapore to carry out the system of jointing and protecting sewer pipes which you advocate."

These letters indicate both the wide circulation of your paper, and the fact that engineers in these remote countries appreciate the fact that sound pavement construction depends on more than the water content or grading of aggregate of concrete, to which so much attention has been paid, whilst sound sewer construction has been neglected.

Toronto, Ont., Canada, A. G. DALZELL,
Dec. 1, 1925. Consulting Engineer.

Dangers of Natural Dams

Sir—The article published in *Engineering News-Record* Sept. 17, p. 467, regarding the dam and barrier formed by the landslide on the Gros Ventre River is of very great interest especially to engineers carrying out work in a mountainous country subject to earthquake shocks and heavy rainfalls.

It may interest you and your readers to know that an occurrence somewhat similar to the Gros Ventre landslide was described to the writer by a Punjab irrigation engineer as having happened in Northern India. In that case there was very grave danger anticipated by a sudden release of the enormous volume of water impounded by the slide and as a result very careful and skillful precautions were taken by the engineering staff to avoid loss of life. It is a good many years since the engineer referred to gave the writer his account of the incident but if the writer's memory is correct the slide was kept under highly skilled observation, an estimate was made of possible maximum flood level which might arise by sudden failure of the barriers, posts were fixed along the valley at estimated flood levels, a system of warnings was carefully arranged, a telephone system was installed for the rapid issue of warnings—and in short all possible precautions were taken to safeguard against loss of life by failure of the barrier. These precautions were not taken in vain, for ultimately the natural dam did fail but not a single life was lost. The engineer who described the incident was enthusiastic about the arrangements which were made to deal with failure of the barrier and although he was familiar with the magnificent engineering works of the Punjab he expressed the opinion that the precautions which were taken in this case amounted to the most admirable example of engineering skill which had ever come under his notice.

The Gros Ventre River landslide appears from the description in your excellent paper to be fairly safe but in the writer's opinion it is one which should be kept under very skillful engineering observation—and continuous observation. A normal flow of 1,600 sec.-ft. must ultimately have a very great effect on the outer and downstream slope of the slide. The sketch map does not give the complete drainage area above the barrier nor is any reference made to the maximum intensity of rainfall and probable percentage of runoff, but if both these factors are high the topography indicates that very concentrated floods may overtop the barrier with exceedingly grave results. Fresh developments will no doubt be duly recorded in your journal, but in the meantime it would be of great interest if you could publish some information as to rainfall records near the slide, probable rate of maximum flood discharge, and what precautions if any are being taken. R. NEILSON,

Stony Hill P. O., Resident Engineer, Hermitage
Jamaica, B. W. I., Hydro-Electric Works.
Nov. 20, 1925.

Temporary Hinges in Concrete Arch Ribs

Sir—In your issue of Nov. 5, the above subject is dealt with in a letter contributed by J. F. Brett of Montreal, in which the case for the adoption of temporary hinges is very ably presented. Since the treatment of these hinges, given in the writer's book "Reinforced-Concrete Bridges," is quoted, some further general remarks may be of interest to your readers.

As Mr. Brett states, temporary hinges have been used for many years in Europe, and they are not by any means a questionable expedient, as stated by Burton Cohen in his review of this book (*Engineering News-Record*, Sept. 17, 1925, p. 479). Stresses resultant from what are usually termed secondary effects, namely, settlement of abutments, elastic compression under load, and shrinkage, in the case of many arches produce greater stresses than those directly resultant from the vertical loading. Moreover, these stresses are permanently present in the arch rib. Fortunately for many concrete arch bridges, the excessive stresses produced by neglect of the above factors in design, are compressive and not tensile stresses. Were the latter the case, immediate evidence of such over-stressing would be forthcoming.

By the use of proper temporary hinges, it is possible, as the writer explains in his book, completely to neutralize the effect of the above factors. For bridges of moderate spans, say up to 100-ft., scientific design is probably not of vital importance, but in larger bridges, such as, for instance, one of nearly 600-ft. span now being designed in this country, proper design, including a thorough analysis of all the secondary effects, is essential if such structures are to be satisfactory permanently, and are to be graceful in outline.

According to the writer's experience, many American concrete bridges are unnecessarily heavy without possessing the same reserve of strength as similar lighter structures to be found in Europe. This is principally due to the fact that lineal variations in arches, due to shrinkage, etc., are independent of the size of the member affected. In designing an economical arch, the axis should be arranged so as to be coincident with the line of pressure resulting from the whole of the permanent loading plus one-half of the average superimposed live-load. If this is done, the minimum eccentricity of thrust is ensured, and with it, the most economical design.

The secondary effects enumerated above, which tend to cause a permanent eccentricity of thrust, are eliminated, so far as the dead weight of the structure is concerned, by the use of properly designed temporary hinges. The subsequent eccentricity of thrust due to the shrinkage and to the elastic compression that would take place after the hinges are filled in, is neutralized by placing the temporary hinges eccentric to the arch axis so as to induce in the arch, moments at the springings and crown equal and opposite in amount.

There are many other devices being employed today in the design of reinforced-concrete bridges in Europe which have passed from the experimental stage and have stood the test of time, and the writer feels sure that when their value is appreciated, concrete engineers in America will not be slow to take advantage of them. W. L. SCOTT.

London, England,
Nov. 30, 1925.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Municipal Engineers Plan New Organization

Engineers in City Employment to Form Nationwide Society to Protect Their Interests

At a meeting held under the auspices of the Association of Engineers of New York on Dec. 21, several hundred engineering employees of the City of New York adopted a resolution favoring the establishment of a national organization for the promotion of the welfare of engineers and particularly those in the employ of municipalities. Two other resolutions were also adopted by the meeting, one of which was to request the state officials, who have the power of appointing commissioners to include an engineer in their selections whenever the problem to be studied by such a commission has an engineering aspect. Too often, it was pointed out, bankers, lawyers and business men compose the entire personnel of commissions acting on technical matters.

Engineers Address Melting

The meeting was addressed by engineers representing the engineering employees of the cities of Chicago, Boston, Philadelphia, Baltimore and New York. The speakers stressed the adverse financial conditions under which engineers are now working in most cities in the country and expressed the fear that unless speedy relief is reported in the nature of favorable salary adjustments there will be a very serious deterioration in the morale and efficiency of the engineering staffs. Among the points given as a reason for adopting the first resolution was the fact that a smaller number of technical college graduates are entering city engineering work each year.

It was reported that the figures and data that the Association of Engineers of New York presented to the Board of Estimate showing the comparatively poor position the city engineering employees occupied in the wage scale received no direct consideration at the time the 1926 budget was made up. However, a million dollar appropriation was set aside at that time for city employee salary adjustment.

Immediately after the meeting a committee of representatives of Chicago, Boston, Philadelphia, Baltimore and New York went into session for the purpose of formulating tentative plans for the organization of the national body favored by the meeting.

Meeting at Boston

A similar meeting was held in Boston a short time ago at which representatives of both engineers in the employ of the city of Boston and in the employ of the State of Massachusetts took a similar action.

The proposed organization will put itself on record as favoring a minimum salary of $2,000 and a maximum of $20,000 for chief engineers. At the Boston meeting it was pointed out that in the state engineering service in Massachusetts the minimum salary is $900 and the maximum $6,000 for chief engineers. The schedule which was adopted at the New York meeting is the result of a study made by the association of Engineers of New York. It outlines the minimum requirements of training, experience and salary for each position.

Engineering Fifty Years Ago

From *Engineering News*, December, 1875

On the Form, Weight Manufacture and Life of Rails

Extracts from a report of the Committee on Rails, Am. Soc. C. E.

THE flange of the rail should not be cut, but the rail kept from crawling, by straps connecting the fish-plates with the ties, or by some other similar contrivance.

Rails should be symmetrical, and inclined to match the conical surface of the wheels, by dressing off the top of the tie, as is the practice in many parts of Europe.

The Chairman has always found so far as his observation went, and has long believed, that the joint on the tie makes the best track. His practice was to place these ties at the joint so close together as to allow for tamping.

The Committee is still unprepared to say much about the manufacture of rails. Some of the ablest rail makers have given the following rules as prominent among those necessary for making good iron rails.

"Select the stock best adapted to each part, the hardest metal for the head, the strongest for the base. Use only grey metal, not white. Put no old rails into the head or base; puddle thoroughly, or the metal will not weld thoroughly. Cut off and throw out all ends of puddle bars; make the top slab about 1¼ inches thick—thicker will not heat before the small bars burn—pile 8 inches square. The top slab should be four-rolled (thrice heated), the bottom thrice rolled and the stem twice rolled; no puddle bars in the rail. Each heating should be uniform and thorough without burning, or the welding will be imperfect."

States Confer on Colorado River Rights

Arizona, California and Nevada Seek Agreement on Water and Power Rights

Conferences between representatives of Arizona, California and Nevada are under way with a view to working out the terms of an agreement acceptable to these three states for the development of Colorado River power and the allocation of water. Some progress in this direction has been made and a proposal approved by California and Nevada delegates was taken under advisement by the Arizona committee with prospect for another joint meeting.

A resumé of the agreement as proposed by California and Nevada is as follows:

1. All water contributed by Arizona rivers to be used solely by Arizona—approximately 1,000,000 acre-feet.

2. Water which is now being used by the states is definitely allocated to the present users. Rights to this water are not in any way affected by the present proposal.

3. One million, ninety-five thousand acre-ft. allocated to California. This is the equivalent of the 1,500 sec.-ft. which has been filed upon by California municipalities for domestic water.

4. Three hundred thousand acre-ft. allocated to Nevada in addition to the entire output of the Virgin River.

5. All remaining water to be divided equally between California and Arizona, with a provision that any of this water which is not in beneficial use by 1975 shall be available for definite allocation to either California or Arizona. This is to protect Arizona in case California should develop a "beneficial use" for the water more rapidly than Arizona.

6. Arizona and Nevada are to be paid one dollar per horsepower of electric energy developed at Boulder Canyon. It it estimated that this will amount to $1,000,000 per year.

Would Issue No Licenses

So as to make sure that no license for water power development will be granted on the Colorado River until the states in the basin come to an agreement, Senator Pittman, of Nevada, has introduced a joint resolution proposing that the authority of the Federal Power Commission to issue licenses covering projects on the Colorado be suspended until February 1, 1928.

In the preamble of his resolution Senator Pittman points out that action by the commission before ratification of a compact by all the states "would embarrass the consummation of the plan" and would "endanger the consummation of a national policy for the coordinated development of the entire river and its tributaries and the highest use of its waters."

Comprehensive Traffic Survey for Illinois

Creation of a Street Traffic Commission to make an analysis of traffic problems for a year and then to formulate a comprehensive traffic plan and uniform traffic code for the Chicago Metropolitan area was effected Nov. 9 by the Chicago City Council. The commission is to be made up of aldermen, city officials and the street traffic committee of the Chicago Association of Commerce which proposes to furnish $50,000 for the first year's survey operations.

The work is to be outlined and carried out under the direction of Miller McClintock as part of the research work of the new bureau of traffic research established by Albert Ruskin Erskine at the University of California. Mr. McClintock has recently completed a similar survey for Los Angeles. A remarkable reduction in accidents and speeding up of traffic has taken place since the installation of a code based on the survey findings. Seven passages, formerly for each intersection opening, have been increased to eleven.

The Chicago survey will utilize the data available in the survey recently completed by the U. S. Bureau of Public Roads and Cook County (see (*Engineering News-Record*, Oct. 29, p. 712). The commission will work in harmony with the Chicago and Regional Plan Commissions. Detail studies will be made of the following subjects: Pedestrians' safety and regulation, street car and bus operation, heavy trucking traffic, traffic signal installation and timing, speed control, parking conditions, street obstructions and law enforcement.

New Piers to Be Built by State at San Francisco

The California State Board of Harbor Commissioners has announced that a start will now be made on a construction program for adding several new piers to the San Francisco waterfront. Funds for this work can be made available at any time by the marketing of $5,000,000 of unsold bonds and the use of $1,500,000 of accumulated surplus. Preliminary plans for further extension of the waterfront contemplate the expenditure of about this total amount.

These plans include the extension of piers 15 and 21 as well as the construction of two new piers (43 and 45) at the north end of the present development and two at the south end (48 and 51). The latter will flank pier 50 which is now under construction.

The new piers, all of concrete with the possible exception of one at the north end where a solid fill is under consideration, will be about 600 ft. long and 350 to 375 ft. wide. This length is sufficient for only one berth and the piers are ultimately to be extended to twice the initial length.

Frank G. White, chief engineer of the state board of harbor commissioners is preparing plans for the new work.

Technical Societies

The list of technical societies and national engineering trade associations of the United States and Canada, prepared by *Engineering News-Record*, is to be reissued early in January. The list gives the names of the societies, membership, secretary's name and address and the time of the annual meetings.

Copies of the list will go to each of the societies included in the list automatically. Additional copies may be obtained from the editor, *Engineering News-Record*.

Contract Let for Long Tunnel in Cascade Mountains

The letting of a contract for a tunnel stated to be 7¾ miles long for the Great Northern Ry. in the Cascade Mountains to A. Guthrie & Co., of St. Paul, has been confirmed by the contractor. Details of the size, exact length, and grades are not yet available.

Canadian Engineers to Meet at Toronto in January

The annual general and professional meeting of the Engineering Institute of Canada is to be held in Toronto, Ont., Jan. 27-29, 1926. The tentative program calls for the annual business meeting and inauguration of the new president on Wednesday and for the presentation of papers Thursday morning and Friday. Subjects of special interest to civil engineers will be the papers on "Deterioration of Concrete in Alkali Soils," "Design of East York Sewers and Their Construction by Contract and Day Labor," "The Water Supply of the Border Cities," on Thursday, and on the subject of highways on Friday morning.

Bridge Over Rio Grande Proposed at Brownsville, Texas

Upon his return to Brownsville from Mexico City a few days ago R. B. Creager made application to the city council for a franchise to use certain streets in the construction and operation of a bridge across the Rio Grande to connect Brownsville and Matamoros, Mexico. He said that he and his associates had obtained a concession from the Mexican Government for the proposed bridge, so far as that country was concerned, and that it was signed by President Calles. The franchise was granted by the city council notwithstanding the opposition of the Brownsville & Matamoros Rapid Transit Co., offered by its president, who asserted that company had the only concession from the Mexican Government for the proposed bridge. It was stated by Mr. Creager, that the bridge which he and his associates plan to build will cost $500,000. They will apply to Congress for permission to construct the bridge.

May Endeavor to Seal Leaks in Whitestone Reservoir

A further report on the leaks under the Horse Springs Coulee earth dam built for the Whitestone Irrigation project in Washington has been made by a board of engineers consisting of D. C. Henny, O. L. Waller, R. K. Tiffany and Lars Langloe. Previous reference to the excessive leakage discovered after the dam was built appeared in *Engineering News-Record*, Aug. 27, p. 361.

This board of engineers recommended in September that further test borings be made above the dam to determine the depth of bedrock and feasibility of putting down a puddled clay cutoff wall. These borings were made as were also estimates on open cut and timbered trench methods of cutoff construction and on sealing the reservoir bottom near the dam with a blanket of puddled material.

The borings showed bedrock at depths ranging up to 103 ft. along a line 120 ft. upstream from the toe of the dam. The estimate for a cutoff made by excavating a trench with sloping sides was $167,600; for a cutoff made in a timbered trench, $100,000, and for a blanket varying up to 8 ft. in thickness, placed on the bottom of the reservoir, $59,125.

The board has therefore recommended that experiments be made with a puddled blanket of tight material sluiced in on a small scale behind the dam to determine what improvement might be effected by a blanket extending some 500 ft. up the valley floor from the dam.

Illinois Engineers Issue Program

A preliminary program of the annual meeting of the Illinois Society of Engineers, to be held at Elgin, Ill., on Jan. 27 to 29, lists the following papers: "Drainage Channel Improvements in Illinois," A. D. Millard; "Work of the State Geological Survey," M. M. Leighton; "Regional Zoning" and "Taking the Hurdles out of our Highways," Robert Kingery; "Economic Value of Steel Reinforcement in Concrete Pavements," H. Eltinge Breed; "Research Work of the U. S. Bureau of Public Roads," A. T. Goldbeck; "Tests of Thin Brick," John M. Egan; "Penetration Macadam Construction and Maintenance," Geo. E. Martin; "Asphalt and its Uses," Geo. W. Craig; "Washed Gravel and Oil for Surfacing Township Roads," H. H. Sherer; "Yield of Wells," Geo. C. Habermeyer and C. V. Swearingen; "Sewage Plant Operation and Experiments at Decatur," W. D. Hatfield; "The Elgin Sewage Treatment Plant," M. H. Brightman; "The Wheaton Sewage Treatment Plant; "Separate Sludge Digestion," L. R. Howson; "Developments in the Chicago Sanitary District," F. W. Mohlman; "The Milwaukee Activated Sludge Plant," T. C. Hatton; "Construction Features of the Bloomington-Normal Sanitary District," J. J. Woltmann; "Manufacture of Sewer Tile," W. D. Gerber. Other papers, including those of the mechanical, electrical and mining section will be announced later.

WASHINGTON NOTES

THE California-Oregon Power Co., has applied for a license providing for the construction of four power houses on the Klamath River in Klamath County, Ore., and in Siskiyou, Calif. The installation is to be as follows: power house No. 1, 97,000 hp.; power house No. 2, 51,000 hp.; power house No. 3, 24,000 hp.; power house No. 4, 48,000 hp.

IN an effort to make the neck of the bottle larger, to use the words of Secretary Jardine, the Department of Agriculture in carrying on research in co-operation with the Port of New York Authority on "Congestion in the Terminal Markets."

Secretary Jardine is recommending that this study of terminal conditions be expanded. More facts must be developed, he believes, before an intelligent solution of the problem can be suggested.

UNDER an authorization in the last River and Harbor Act the Corps of Engineers is studying the problems of improving the upper Mississippi. General Harry Taylor, the Chief of Engineers, after a personal study made on the ground, says a depth of 6 ft. below the mouth of the Wisconsin river can be obtained without difficulty as constructive works can be constructed with a small amount of bank protection. From the mouth of the Wisconsin river to St. Paul a depth of 6 ft. could be obtained by similar construction, but General Taylor regards it as inadvisable as it would narrow the channel to such an extent as to introduce navigation difficulties. He inclines to the use of locks and dams. Whether low movable dams or high dams, permitting of power development, should be built can be determined only after accurate figures are available as to the flowage damages that would have to be paid. High dams would make necessary relocation of railroad tracks and would run into large expense otherwise.

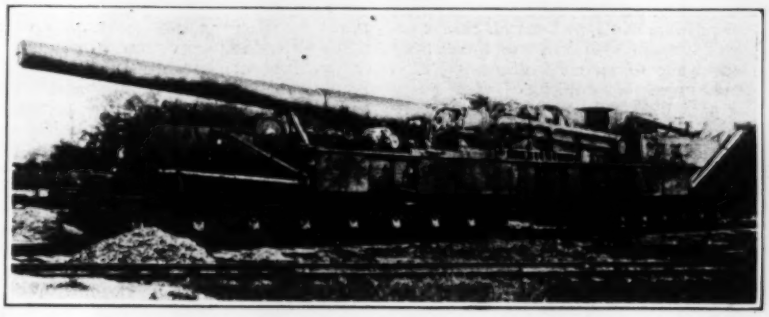
PRESIDENT COOLIDGE'S suggestion in his budget message that the federal-aid highway system be reduced fifty per cent seems to have little chance to secure the approval of Congress. Chairman Dowell of the House Committee on Roads has introduced a bill authorizing the appropriation of $80,000,000 for federal aid for the next fiscal year and a similar amount for the year to follow. This action is understood to have the approval of a majority of the committee. Hearings on the bill will be begun shortly after the first of the year at which an unusual effort will be made to build up a strong record. The printed copies of the hearings will be distributed widely and will help materially, it is believed, to arouse public sentiment for the amount asked, which is the average of the federal aid actually absorbed during recent years.

The opposition will concentrate its attack on the bill when it gets to the Senate, where Senator Reed of Pennsylvania has been selected to lead the attack. There is a chance to delay the consideration of the measure in the Senate but the strength to defeat it cannot be mustered, it is believed.

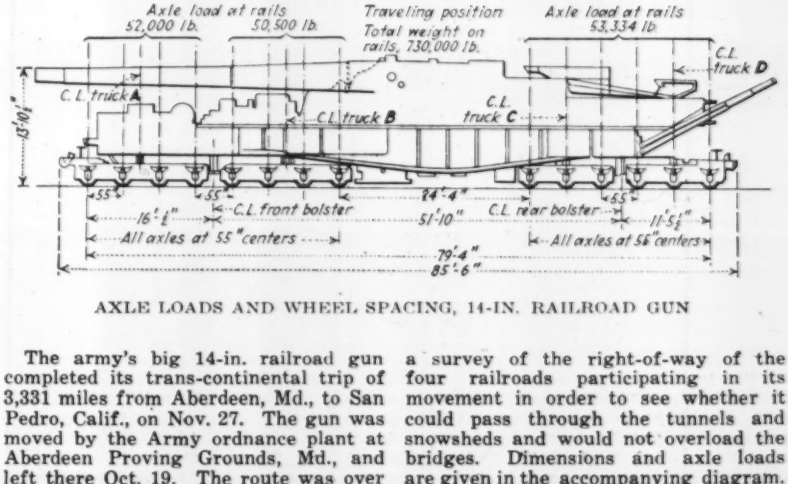
CONTROL of transportation during war should be vested in the Secretary of War in the opinion of Dwight F. Davis. An opinion to that effect was formulated by Mr. Davis when he was Assistant Secretary of War. This recommendation forms a part of the annual report of the assistant secretary. It reads, in part, as follows:

"Plan for control of transportation in war: In the last war railroad transportation was one of the most critical industrial elements, and at one time it appeared that transportation might be the limiting factor of the entire munition program. In any major emergency it is essential that the railways of the country be operated under unified control for the greatest efficiency. A tentative plan was drawn up in my office for the control of railway transportation in a major war. The plan is based on the experience of the last war, and was formulated after discussion with officials of the Association of Railway Executives. The plan contemplates that the railways will be taken over by the Secretary of War, as provided in the army appropriation act of August, 1916, and general direction and control will be exercised by the Secretary of War. The actual operation and the carrying out of general policies will be left largely to existing railway organizations, and the railroads will not be taken over by the Government at all unless the emergency is so great that such a step is necessary. In order that co-operation may be secured between the Army and the railroads in solving local transportation problems, the American Railway Association has appointed an official in each of the fourteen Procurement Districts."

Heavy Railroad Gun Taken to Pacific Coast



14-IN. RAILROAD GUN IN TRAVELING POSITION



AXLE LOADS AND WHEEL SPACING, 14-IN. RAILROAD GUN

The army's big 14-in. railroad gun completed its trans-continental trip of 3,331 miles from Aberdeen, Md., to San Pedro, Calif., on Nov. 27. The gun was moved by the Army ordnance plant at Aberdeen Proving Grounds, Md., and left there Oct. 19. The route was over the Pennsylvania R.R. to Chicago, thence over the Chicago & Northwestern to Council Bluffs, over the Union Pacific to Ogden, and over the Southern Pacific to San Pedro. Transportation of the gun across the continent required a survey of the right-of-way of the four railroads participating in its movement in order to see whether it could pass through the tunnels and snowsheds and would not overload the bridges. Dimensions and axle loads are given in the accompanying diagram.

The gun has a range of 25 miles and fires a projectile weighing from 1,200 to 1,500 lb. It is the first heavy railroad mounted gun built for defense of the Pacific Coast as well as the first to be sent there on its own carriage.

Next Conference on City Plannings to Be Held in Florida

The 1926 National Conference on City Planning will be held at St. Petersburg, Fla., March 29-31 and at West Palm Beach on April 1. The secretary is Flavell Shurtleff, 130 E. 22nd St., New York City.

Arch Dam Investigation

Further progress on the arch dam investigation being made by the Engineering Foundation, given in its Bulletin 2 of Dec. 1, indicates that on Nov. 1 the camp at the site of the proposed test dam on Stevenson Creek near Fresno, Calif., had been built, machinery for excavating the foundations and placing concrete had been installed, and 1,274 cu.yd. of rock had been excavated in preparing the site.

Major Grant to Succeed Colonel Sherrill at Washington

Maj. U. S. Grant, 3rd, will be named to succeed Lieut. Col. C. O. Sherrill whose resignation as director of the Office of Public Buildings and Grounds, Washington, D. C., to become city manager of Cincinnati, Ohio, was announced in our issue of Dec. 10, according to a report from Washington. For some time past Major Grant has been executive assistant to Colonel Sherrill. Major Grant was born in Chicago, July 4, 1881, studied in Columbia University before going to West Point, graduated from West Point in 1903, and was commissioned a second lieutenant in the Corps of Engineers. His first service was in the Philippine Islands and then in Mexico. From 1913 to 1917 he served on the Mexican border and in 1918 and 1919 was assistant commissioner negotiating with Germany relative to prisoners of war and later with the American Peace Commission at Paris.

Legislature to Consider Tolls on Philadelphia-Camden Bridge

Possible early agreement between the states of New Jersey and Pennsylvania by which the tolls dispute that has prevented completion of the Delaware River Bridge between Philadelphia and Camden may be settled, is forecast in the listing of the tolls dispute as an item of business to be considered by the Legislature of Pennsylvania at a special session. The call for the special session was issued Dec. 14 by Governor Pinchot, for the Legislature to convene Jan. 13. If the Legislature repeals the law passed last year at the regular session, requiring that the bridge shall be free of tolls on vehicular traffic, it will leave the issue open for negotiation and possible compromise. A poll made by the *Philadelphia Record* has indicated that public sentiment in Pennsylvania favors a toll bridge and as a result of this poll several members of the Legislature have stated they would be willing to vote the repeal of the law passed at the last session.

Immense Sewage Disposal Scheme Advised for Detroit

The Sewage Treatment Committee of Detroit has submitted a report advising a main and branch intercepting sewers and a sewage work at an estimated cost of $39,600,000, which it recommends be put under construction at once for completion within seven years. Consulting engineers to the commission were Clarence Hubbell, formerly city engineer of Detroit, Harrison P. Eddy, Boston, and Prof. John J. Gregory, Baltimore. The commission was composed of: Chairman, A. C. Marshall, vice president and general manager, Detroit Edison Co.; P. A. Fellows, city engineer; George R. Cooke, contractor; Francis C. McMath, president and chief engineer, Canadian Bridge Co.; and Lewis C. Rogers, Solvay Process Co.

New Methods of Electing Officers Proposed to Civil Engineers

Several important amendments to the constitution of the American Society of Civil Engineers have been submitted to the members for discussion at the annual meeting to be held in New York Jan. 20, 1926. One amendment proposes to increase the credit given for a four-year college course in the application for membership in the society from two years to four years. The second proposal places the responsibility for initiating action looking towards expulsion of members upon the Board of Direction, requiring the affirmative vote of at least 80 per cent of the membership of the board in order to expel a member. The more important proposals are two different amendments both designed to alter the method of electing officers. They are too involved to be given in abstract here. Members who have not received copies of the proposed amendments can obtain them from the secretary.

Second Narrows Bridge at Vancouver Completed

The combined railway and highway bridge over Burrard Inlet at Second Narrows, connecting the towns of Vancouver and North Vancouver, B. C., which was begun in September, 1923, was completed and opened for traffic in November of this year. The total length of the crossing is 1¼ miles, made up of 4,500 ft. of embankment, 1,500 ft. of timber trestle and 7 steel trusses including a bascule 185 ft. long, and one 300-ft. through truss. The foundations of the main channel spans are cylindrical piers, some of which are carried to a depth of 106 ft. below water level at a point where the Narrows is 85 ft. deep.

The bridge deck consists of a standard gage railway track in the center flanked by two 10-ft. roadways, one on each side, with sidewalks on the outside.

The bridge was built at a cost of $1,800,000 by the Northern Construction Co., William Smaill, chief engineer. The steel work was built by the Dominion Bridge Co.

Random Lines

A Christmas Greeting

The San Francisco Engineers' Club sends the following:

YE CHRISTMASTIDE RETURNS

Right joyously ye Xmas Chimes
Burgeon with merrie tune:
"Ye Yuletide has returned betimes!"
(Unconscionably soone.)

Ye bagge-puddeyne and spitted fowle
Broadcasting to ye skies,
Bring ardor to ye hungrie jowle
And sparkle to ye eyes.

And in ye Engyneere there sings
A Xmas spirit fine
Which from ys booke of Trautwine brings
Less thought of troute than wyne.

So faring to ys meetnge place
In Quest of Xmas cheere
He greets with joyous, beamynge face
Ys brother Engyneere.

Agayne ye Choristers give voice
Agayne ye fiddles squeake
Agayne (lest we too well rejoice)
Ye tyresome speakers speake!

Then warmed with goodlye friendship faste
Replete with costly foode,
Ye Engyneeres depart at laste
In gentle kindly moode.

The Employer Complex Again

For some years we have been contending against fearful odds that the new college graduate is a much maligned man, that far from being the swelled head his older, and employing brethren like to consider him he is modest to the degree of humility. At last we have a recruit to our view in F. P. A., the columnist of the New York *World*, who says:

"According to the findings of a committee from Yale, university graduates are unpromising candidates for executive positions in transportation work. As to these findings, we doubt their worth. When the committee says university graduates, it means, we think, the recently graduated. The chances are that such men are unpromising candidates for executive positions in any work. And what of it? 'College men overrate their value when green to the company,' the committee finds. Taking this to mean the just graduated, we don't believe it. It takes most college graduates, we find, from five to fifty years to get over their inferiority complices. And twenty-five years ago we'd have apologized for that plural."

* * *

For Use in Their Dining Cars?

"The Baltimore and Ohio has closed contracts for 3,000,000 tin plates and other accessories. The New York Central is inquiring for 3,000,000 to 5,000,000 tin plates and 25,000 to 45,000 kegs of spikes." –Baltimore *Evening Sun.*

Ontario Urging for St. Lawrence Power Development

Owing to a prospective shortage of electric power in the province of Ontario, the Ontario government is urging the provincial government to recognize the right of the province of Ontario to proceed with the development of hydroelectric power on the St. Lawrence river, and to speed up the negotiations between the United States and Canada which relate to the development of power on the St. Lawrence.

At the coming session of the Dominion legislature in January two motions will be introduced by members from Ontario, one advocating a treaty between the United States and Canada for the immediate development of the St. Lawrence, and the other recommending that the Ontario government and the Ontario Hydroelectric Power Commission be given authority to develop power at Morrisburg on the St. Lawrence and to make an increased draft upon the waters at Niagara.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ROAD BUILDERS ASSOCIATION, New York City; Annual Convention, Chicago, Ill., Jan. 11-15, 1926.

AMERICAN ENGINEERING COUNCIL, Washington, D. C.; Annual Meeting, Washington, D. C., Jan. 14-15, 1926.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual Meeting, Portland, Ore., Jan. 19-23, 1926.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York City, Jan. 20-22, 1926.

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Toronto, Ont., Jan. 27-29, 1926.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 23-26, 1926.

The San Francisco Section of the American Society of Civil Engineers held its annual meeting Dec. 15. The election of a president and second vice-president for 1926 resulted as follows: President, B. A. Etcheverry, professor of irrigation engineering, University of California; second vice-president, W. H. Kirkbride, engineer of maintenance-of-way and structures, Southern Pacific Co. The principal paper was presented by Robert M. Morton, state highway engineer, on "Engineers and State Highway Construction."

The National Drainage Congress is to hold its annual convention at Oklahoma City, Okla., Jan. 18 to 20, with headquarters at the Huckins Hotel. The president is E. V. Willard, consulting engineer, St. Paul, Minn.; secretary, C. R. Thomas, 53 W. Jackson Boulevard, Chicago.

The Engineers Sub-Division of the Chicago Association of Commerce has elected Albert F. Reichmann chariman and E. S. Nethercut vice-chairman for the year 1926.

The Kansas Engineering Society at its annual meeting held at Emporia, Dec. 9 to 11 elected the following officers: President, W. E. Baldry, city engineer, Topeka; vice-president, M. Roseberry, county engineer of Sedgwick County, Wichita; and secretary-treasurer, J. M. Averill, Topeka.

The Kansas Section of the American Society of Civil Engineers at its meeting Dec. 10 held in Emporia elected the following officers: President, W. V. Buck, state highway engineer, Topeka; vice-president, P. L. Brockway, Wichita; and secretary-treasurer, F. W. Epps, consulting engineer, Topeka.

The Seattle Section of the American Society of Civil Engineers held a joint meeting Dec. 15 with the city's sections of the mining, mechanical and electrical engineering societies, the Skagit Power Project being the principal subject, with speakers Joseph Jacobs, Stirling B. Hill and W. C. Morse, engineers who were members of the Skagit Engineering Commission.

Personal Notes

C. S. RINDSFOOS has announced his resignation as secretary-treasurer and director of Jarrett-Chambers Co., Inc., Engineers and Contractors, of 30 East 42nd Street, New York City, to take effect Jan. 1, 1926. Mr. Rindsfoos has accepted the position of vice-president and director of The Brunson Co., The Brunson Savings Bank, and The Brunson Savings and Loan Co., of 145 North High St., Columbus, Ohio, in charge of the mortgage loan departments of these companies.

E. R. SMITH, former deputy engineer of Walla Walla County, Washington, has been named county engineer to succeed the late Lincoln L. Kennedy, whose death was recorded in these columns Dec. 10. It may be noted here that the county commissioners have officially changed the name of a new bridge in Walla Walla County to the Lincoln O. Kennedy bridge in memory of the late county engineer.

O. N. HANSFORD, who was connected with the Colorado state highway engineering department has been appointed county engineer for Pueblo County, Colo. Mr. Hansford relieves Charles B. Clark, who has resigned.

C. T. FOGLE announces that the office of the C. T. Fogle Construction Co. has been moved from Jefferson City, Missouri, to the Graham Building, Jacksonville, Florida.

JOHN W. GRAHAM, Chillicothe, Ohio, who has been a division engineer of the state highway department in Ohio, has been appointed city engineer of Chillicothe. Mr. Graham's first service, after graduation from Ohio State University in 1907, was in the Bureau of Public Works in the Philippine Islands.

THOMAS G. REILLY until recently connected with the staff of the engineer of Essex County, New Jersey, has opened an office in Caldwell, N. J.

Obituary

CLARENCE LORING HUSSEY, bridge engineer of the State Board of Public Roads of Rhode Island, died at Providence, Dec. 5 at the age of 41. He had served the state as highway bridge engineer for nearly fourteen years, and brought remarkable energy and originality to his work. Born in Milford, Mass., Nov. 16, 1884, he graduated from Massachusetts Institute of Technology in 1908. He passed four years in the service of the Providence Engineering Works, F. D. Sheldon & Son, and the Rhode Island Electric Car Co. in various lines of testing, designing and construction. In July, 1912, he became engineer in charge of design and construction of highway bridges for Rhode Island, and continued in this position until the time of his death. In this service he supervised the design and construction of more than one hundred bridges on the state highway system, and made the preliminary investigation and design of the proposed three million dollar Washington bridge over the Seekonk River connecting Providence with East Providence. Recently he was directing the examination and preliminary design for a proposed toll bridge across Mount Hope Bay to connect the island of Rhode Island on which Newport is located, with the mainland at Bristol, and to provide a direct route between Providence and Newport. One of the special features contributed to Rhode Island bridge work by Mr. Hussey was a concrete arch bridge design in which the sidewalk and railing were carried on brackets projecting from the arch ring, the back of which bracket carried inclined spandrel walls. This design reduced the dead-load from spandrel fill and resulted in large savings over the more conventional design. He also made noteworthy innovations in light railing design, in the selection of mineral aggregate for concrete to insure high strength, in the use of special mixtures for contraction joints, permitting a larger range of use of such joints, and other detail features of the work in his charge.

SIR GEORGE S. GIBB, former managing director of the Underground Electric Railways Co., of London, England, died recently in his 75th year. He has also held the positions of general manager of the Northeastern Ry., for fourteen years, and was later chairman and managing director of the Metropolitan District Ry. of London.

From the Manufacturer's Point of View

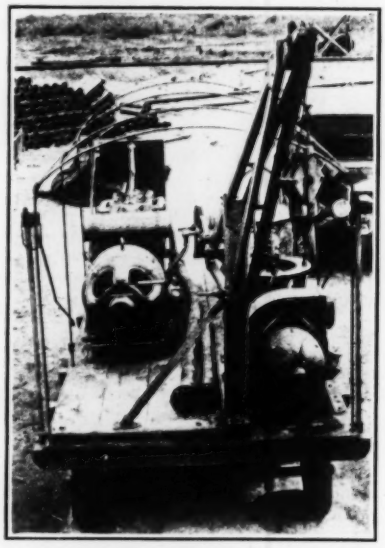
A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Equipment for Sewer Maintenance Mounted on Trailer

WITH a view to having everything necessary at hand to clean out an obstructed sewer, even to blowing out obnoxious and dangerous gases, the Milwaukee Sewerage Commission has had built the mounted maintenance equipment shown herewith. It is called a power trailer, and T. Chalkley Hatton, chief engineer, states it has been used with great satisfaction in connection with the intercepter system. The side view shows the derrick, blower, two sections of the pump, starting box and rheostat for motor and switchboard for generation of motor, blower, generator, pump generator and lights. Below is the tool box for important wrenches and light cable. On the far side of the trailer is the generator and motor. The end view shows motor and generator on the left with blower and pump on the right. The suction and discharge pipes are carried in the center.

The motor is a 4-cylinder gasoline Wisconsin marine engine, operating at 1,200 r.p.m., taken from a motor boat. It furnishes power for the pump and other auxiliary equipment. A gasoline tank, fan and water radiator were added to make the power unit complete. The generator is a 25-kw., 250-volt Allis-Chalmers unit connected to the motor with flexible coupling of cloth belting.

The 2½-in. centrifugal pump of the mine sinker type manufactured by the American Well Works was designed to deliver 250 to 300 gal. per minute against 85 ft. head when running 1,750 r.p.m. It is driven by a 15-hp. General Electric motor and is equipped with suction foot valve. A sheet steel protecting hood covers the generator. The unit is 27½ in. overall diameter so that it can pass through a standard manhole frame of 30½ in. A 2-hp. motor drives

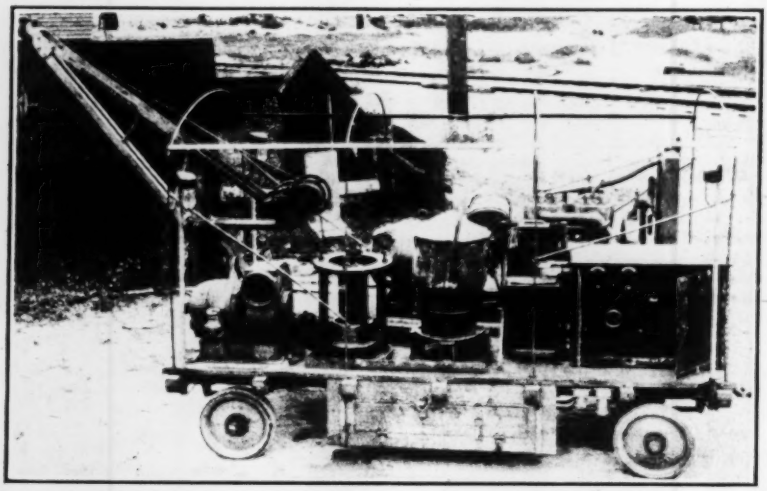


END VIEW OF SEWER MAINTENANCE MOUNTED EQUIPMENT IN MILWAUKEE

the 25-in. fan, at 1,750 r.p.m., manufactured by the Bayley Mfg. Co. The motor is equipped with a Cutler-Hammer fully enclosed starter. The circle-swing derrick, manufactured by Sasgen Derrick Co., is capable of lifting a 2,500 lb. load and has a drum capacity of 275 ft. of ¾ in. cable.

The Rix trailer is a low-wheel type hauler 12 ft. long with extra cross bracing in the center built to carry a 2,500 lb. load. It is front steering only. The switchboard, cabinet, switches and controls are all General Electric Co. equipment.

All of the work of assembling the equipment and of building the platform and form for carrying the 10-oz. tarpaulin top was done by the mechanics of the Commission. Exclusive of labor the cost was $2,900 for the whole outfit.



TRUCK TRAILER CARRYING DERRICK, PUMP, BLOWER AND POWER UNIT
Circle swing standard building derrick can drop pump into sewer manholes. Blower can be used first to clear manhole of dangerous gases

Practical Hints on Installation and Care of Valves

The Kennedy Valve Mfg. Co., Elmira, N. Y., in its catalog on valves, pipe fittings and fire hydrants, states that the observance of the following suggestions will protect the fitter, contractor and owner from much trouble and possible danger, and will avoid unjust complaint to the valve manufacturer about defects which arise only through the negligence and abuse of the valves. The suggestions are very practical and while written specifically for Kennedy valves apply equally well to the maintenance of any kind of valve. They are reprinted below.

Avoid wrench strain—do not try to force an obstinate joint with an extra long handled wrench. A comparatively slight strain on the wrench is sufficient to warp the body and throw the seat of a valve out of line. Screwing too long and unsupported lengths of pipe into a valve is always bad practice for the weight of the far end exerts a powerful leverage after it is fastened in the valve.

Don't cut pipe threads too long—threads that go into a valve too far strike and distort the seats and ruin the valve.

Keep dirt out—It cuts and scratches the disks and seats making a leaky valve out of a tight one.

Put pipe compound or cement on the pipe thread and not on the valve thread—putting it on the valve thread causes it to be pushed into the valve. It may get on the seats and disks and make trouble.

Keep valves tightly closed while being connected to pipe—this makes the valve as rigid as possible and less liable to strain besides serving to keep from the working parts pipe compound, dirt and chips that would be likely to injure them.

Blow out valves thoroughly before putting into service—this will usually remove any substances that are liable to stick to and injure the disks and seats.

Provide ample support for maintaining alignment—keep the line free from sag. Leakage and permanent damage to valves are often directly due to the neglect of this precaution.

Don't apply a wrench to the hand wheel—applying a wrench for tighter closing on a worn valve is a good way to distort or break the part. When seat faces need renewing it is cheaper to put new ones in.

Open valves carefully—valves on any pressure line should be opened gradually.

Inspect valves regularly—every valve

should be operated completely between limits at least once a month and the packing readjusted in case of leakage.

Protect valves from freezing.

Get rid of expansion leaks on new steam lines—this may usually be overcome by the fitter tightening up the nuts of the bolts joining the flanges on the line connecting the pipe fittings and valve. Oftentimes, however, he overlooks the flanges connecting the bodies and caps of the valves. Remember that the valve in such cases is subject to precisely the same conditions as the direct line, so the same treatment obviously should be applied to all its flanges.

Business Notes

CLIMAX ENGINEERING CO., Clinton, Iowa, announces the appointment of two new sales representatives. R. B. Sinnock will make his headquarters at Clinton and will handle sales of the company's gasoline engines in the territory adjacent to that point. C. H. Adams has been appointed sales representative for the southeastern portion of the United States.

ROBERT ADLER, for the past 12 years connected with the Truscon Steel Co., Youngstown, Ohio, during the last seven of which he held the position of manager of the Minneapolis district, has resigned, effective Dec. 15.

HENRY C. HOUCK, assistant general merchandise manager, General Electric Co., Schenectady, N. Y., has been appointed manager of the merchandise department at the Bridgeport works of the company. His appointment will take effect immediately.

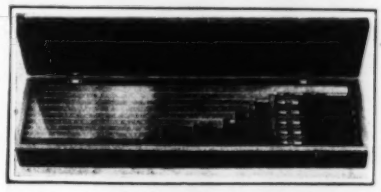
Equipment and Materials

New Styles and Sizes of Lettering Guides

The lettering equipment manufactured by the Wood-Regan Instrument Co., 154 Nassau Street, New York City, has been increased by the addition of several new sizes of lettering guides for vertical characters and a complete new line has been designed and is now available for slant lettering. The guides are not stencils but incorporate some unique details of design that insure rapid and perfectly uniform letters. There are nine different sets each consisting of a number of transparent guides cut with openings for making the alphabet, all numerals, and common signs with special pens for different weight lettering. One of these sets is illustrated.

The center portion of the guide is grooved on the underside so as to provide clearance over the lettering, thus eliminating any possibility of blotting when the guide is moved. Wherever it has been possible so to do a single opening has been provided for the formation of a complete character in one operation. All other characters are made in two operations by means of complementary openings. The amount of shift between these complementary openings is the same for all characters and automatically regulated by the shift button at the end of the guide, as shown in the illustration.

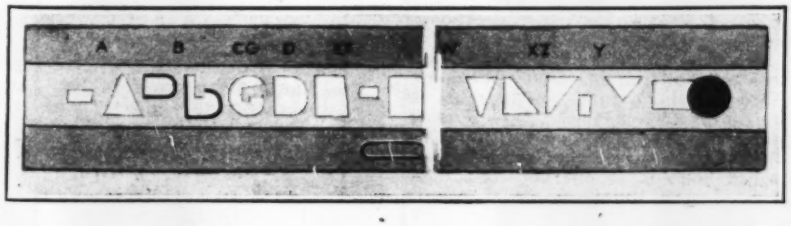
This shift button is an important feature of the equipment. Its function is as follows: The third and fourth openings from the left in the illustration of the guide are the complementary openings for the letter B. Assume that first the pen followed the fourth opening forming the vertical side and lower hook of the letter. The



button is then pressed down at the right end of the slot and the guide slid toward the right until the button is flush against the left end of the slot. This automatically brings the upper hook of the letter, the third opening, to exact position for completing the B. The other characters requiring separate operations are formed in the same manner. In no case is more than one shift required.

The pens have been designed especially for use with these guides and the complete set of pens affords an ample range of weight in lettering. The frames of all the pens are the same, consisting of a tubular holder, to which is attached a funnel-shaped ink well. The points of the four larger size pens are of the same diameter where they come in contact with the guides, the variation in size being in the extreme tips. This makes possible a variety in width of line without affecting the symmetry of the characters. In operation, the lettering guides are placed with either their upper or lower edge in contact with any straight edge.

This lettering equipment is being used by companies with large drafting rooms, among which are the United States Rubber Company, and the American Telephone & Telegraph Company. The latter has also had a special set made for the formation of some of the many electrical symbols used on its drawings. The standard sets of lettering guides are available for characters ranging in height from $\frac{3}{32}$ in. to $\frac{1}{2}$ in.



Publications from the Construction Industry

Metal Lath—MILWAUKEE CORRUGATING CO., Milwaukee, Wis., in its new book "Modern Modes in Better Plastering," shows how metal laths used as a base for plaster provides a means of placing period design in the plaster as well as giving permanence and economy in application.

Tractor Equipment — LA PLANT-CHOATE CO., Cedar Rapids, Iowa, in a new 32-page catalog describes its equipment for use with tractor motive power. This equipment includes dump wagons, bull dozers, hydraulic spacers, reach trailers, platform trailers, and snow plows. Construction details are illustrated and described and a number of testimonials and construction illustrations are given of the equipment in use on representative jobs.

Materials Handling — WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., describes in a new 30-page catalog its electrical equipment that has been developed for material handling machinery. The pages of the circular contain information and data covering the principal groups of materials handling machines, giving their uses, typical outputs and the electrical equipment best suited for their successful operation. Cranes, hoists, winches, conveyors, coal loading machines, freight elevators, trucks, locomotives and dredges are some of the types of equipment that are described and illustrated.

Power Shovels—ORTON & STEINBRENNER CO., Chicago, in bulletin No. 39 describes its $\frac{1}{2}$, $\frac{3}{4}$ and 1 yard power shovels. These shovels are powered by gasoline or electric motor units. Illustrations and descriptions of specific details of the machine are given as well as many operating photos.

Welding Supplies—LINCOLN ELECTRIC CO., Cleveland, Ohio, has just issued a new catalog dealing with welding supplies. Welding machines are dealt with in brief. Supplies covered include cables, glass, shields, welding electrodes, aprons, gloves, brushes, electrode holders and other accessories needed for this type of work.

Cold Weather Mortar — NATIONAL LIME ASSOCIATION, Washington, D. C., has published the results of recent tests by the Engineering Society of Wisconsin, performed at the University of Wisconsin, for the purpose of determining

the kind of mortar best suited for construction during the cold weather. The booklet describes the different tests and conclusions reached. One part portland cement, two parts lime and nine parts sand was considered to be the most satisfactory mix to withstand the effects of low temperature.

Electrical Control—GENERAL ELECTRIC CO., Schenectady, N. Y., announces a new industrial control catalog for 1926. The publication contains instructive matter on the care and operation of control devices; wiring diagrams of some standard controllers, push buttons and other accessories; reference tables; and other information of importance to the user of electric motors. The booklet contains 160 pages of descriptive matter, illustrations and tables.

Tractors—MEAD-MORRISON MFG. CO., Boston, Mass., devotes its new Catalog 26 to its recent product, the "55" crawler tractor. The first part of the book is devoted to illustrations and descriptions of structural details in the machine. This is followed by photographs of the various models and several pages of illustrations showing the tractor in use on road work, logging operations, industrial plant hauling, and snow removal.

Industrial Locomotives—MILWAUKEE LOCOMOTIVE MFG. CO., Milwaukee, Wis., has recently announced two new publications, one covering its Type H gasoline locomotive, of 3½ to 7 tons, and the other covering its Type H gasoline locomotive 9 to 15 tons. The bulletins give complete general descriptions of power plant and construction details of the equipment, together with condensed specification tables for each size of locomotive.

Concrete Pavement—AMERICAN VIBROLITHIC CORP., Des Moines, Iowa, has just issued a booklet entitled "Paving America with Vibrolithic." The booklet is made up of a complete list of the communities in which the Vibrolithic system has been used in the construction of pavement, and gives the year of construction as well as other pertinent facts.

Water Indicators—LEUPOLD, VOLPEL & COMPANY, Portland, Ore., have issued a data book on water level recorders and indicators, containing descriptions, illustrations and designs of stilling wells and instrument shelters. The booklet also contains a treatise on the inherent sources of error in all float operated devices.

Portable Saw Rigs—WITTE ENGINE WORKS, Kansas City, Mo., has available a new catalog giving descriptions and illustrating design details of its line of oil-fuel engines and portable saw rigs.

Tractors—CLEVELAND TRACTOR CO., Cleveland, Ohio, has recently made available a small pamphlet entitled "When Winter Comes," describing and illustrating its crawler tractor in operation under winter conditions.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

This Week's Contracts—Week Ago—Same Week Last Year

THE money value of contracts reported in the present issue of *Engineering News-Record* is here compared with the figures for corresponding weeks. Minimum costs observed are: $15,000 for water-works and excavations; $25,000 for other public works; $40,000 for industrial and $150,000 for commercial buildings.

Money Value of Contracts Let—Entire U. S.

Week Ending	Public Work	Private Work	Total Contracts
December 24, 1925	$16,412,000	$58,307,000	$74,719,000
December 17, 1925	17,142,000	35,444,000	52,586,000
December 25, 1924	14,120,000	32,806,000	46,926,000
Heaviest Week			
1925, Sept. 3	16,215,000	69,424,000	85,639,000
1924, May 8	26,370,000	38,829,000	65,199,000
January 1 to Date			
1925	1,027,540,000	1,518,167,000	2,545,707,000
1924	953,919,000	1,045,371,000	1,999,290,000

Present Heavy Rate of Building Materials Production Shows Preparation for Extensive 1926 Program

LED by steel, which will probably break all records this year for ingot output, other basic materials are being produced to a degree consistent with an unprecedented demand.

Florida developments have a lot to do with the unseasonally large volume of building materials shipments, especially in brick, pine lumber, and tile.

Production, substantially in excess of demand, and quick freight shipments everywhere except in the Florida district, have prevented abrupt advances in construction cost.

Expansion in demand is noted in current reports by the Department of Commerce on locomotives, malleable and commercial steel castings, fabricated steel plate, floor and wall tile, and architectural terra cotta. The slight recession in automotive demand, plumbing-fixture requirements and new orders for paving brick is evidently seasonal. November structural steel bookings showed a decline for the first time since 1923.

Owing to prompt freight deliveries, the bulk of reserve stocks has heretofore been kept at mills, with moderate supplies at local warehouses. Now, some of the mills are showing an inclination to sign contracts for delivery in the near future rather than accumulate heavy bookings of unfilled orders for shipment over protracted periods of time.

The situation in detail in four of the principal building materials follows:

Steel—Total output for the mills of the country by the end of the current year, will have exceeded the total for 1917, the previous record year, by perhaps a fraction of one per cent. The gain, though slight, is all the more significant because of the absence of war-time conditions. Monthly production of ingots, all companies, as calculated by the American Iron and Steel Institute, is as follows:

	Tons	
	1925	1924
January	4,198,564	3,649,913
February	3,756,243	3,826,246
March	4,198,520	4,206,699
April	3,587,524	3,348,466
May	3,458,253	2,640,034
June	3,207,056	2,065,676
July	3,087,590	1,877,789
August	3,424,034	2,552,891
September	3,492,904	2,827,625
October	3,893,028	3,125,418
November	3,907,353	3,121,149
11 months	40,211,069	33,241,906

Lumber—Unfilled orders at 359 mills for the week ended Dec. 12, were about 7 per cent under those for the corresponding period last year and nearly 15 per cent heavier than for the week preceding, according to the National Lumber Manufacturers Association. The demand for Southern pine in Florida is exceptionally heavy, running largely to lath, yellow pine flooring, timbers, common boards, dimension lumber, special cutting, and finish.

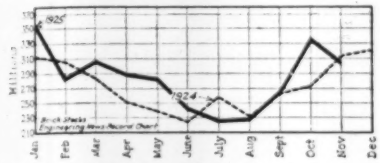
The following table compares the national lumber movement for the three weeks indicated:

	Week of Dec. 12 Ft. b.m.	Corresponding Week in 1924 Ft. b.m.	Preceding Week in 1925 Ft. b.m.
Production	227,645,442	221,023,108	210,713,199
Shipments	238,122,045	237,514,350	229,320,874
New business	246,716,691	267,095,765	214,838,495

The lumber movement for the first fifty weeks of 1925 compared with the same period in 1924, follows:

	Production Ft. b.m.	Shipments Ft. b.m.	Orders Ft. b.m.
1925	12,013,477,874	11,881,761,775	11,729,427,133
1924	11,494,385,413	11,469,886,673	11,354,430,754

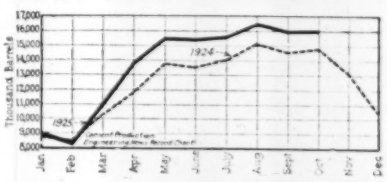
Brick—According to the Common Brick Manufacturers Association of America the end of 1925 will find consumption of common brick in such large centers as New York, Chicago, Detroit, Los Angeles, San Francisco, Cleveland, and generally throughout New England,



ahead of 1924. Chicago alone uses nearly 1,250,000,000 common brick yearly. A recent check-up of future orders in about twenty of the largest construction centers, indicates that 1926 will not fall behind the current year. The following tabulation shows the situation as of Nov. 1, 1925:

1924	Burned Brick on Hand M	Unburned Brick on Hand M	Brick Moved from Yards During Month M	Orders on Books M
Nov. 1	312,061	44,543	135,806	186,977
1925				
Jan. 1	354,477	51,162	118,759	202,906
Feb. 1	279,862	23,951	94,185	201,479
Mar. 1	305,831	34,891	110,790	247,176
Apr. 1	287,800	43,446	170,697	329,673
May 1	281,858	71,266	206,551	339,629
June 1	239,389	67,480	180,851	333,967
July 1	225,401	82,987	173,215	326,226
Aug. 1	227,306	92,267	180,407	292,775
Sept. 1	265,897	89,608	159,309	301,913
Oct. 1	338,857	104,066	171,830	252,511
Nov. 1	306,588	86,164	142,542	262,534

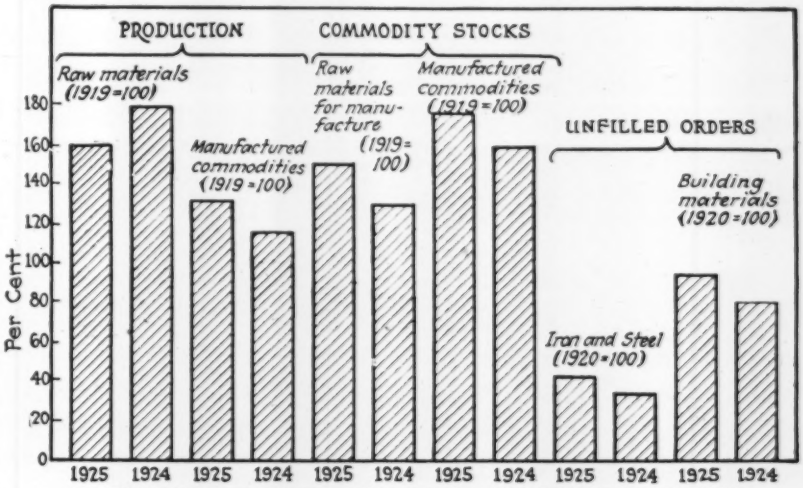
Cement—At the present rate of output, total 1925 production for the entire country will amount to about 160,907,000 bbl., or an increase of 8 per cent over 1924. According to latest reports of the Bureau of Mines, production is greater and shipments lighter than a year ago, while mill stocks are



nearly 62 per cent heavier. The output, slightly in excess of demand, is probably the chief cause of the present stability of cement prices. The largest mill reserves are in Wisconsin, Illinois, Indiana and Kentucky. New York State, however, is the heaviest consumer. Imports are in excess of exports, with the bulk of the foreign cement coming from Belgium, Canada and Norway. Florida, for instance, in October, 1925, took the following from foreign countries:

	Barrels
Belgium	60,534
Canada	46,563
Cuba	43
Norway	6,708
Total	113,848

Florida used 535,817 bbl. of domestic cement during the same month.

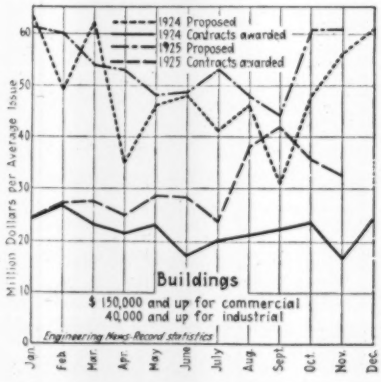

PRODUCTION
COMMODITY STOCKS
UNFILLED ORDERS
Raw materials (1919=100)
Manufactured commodities (1919=100)
Raw materials for manufacture (1919=100)
Manufactured commodities (1919=100)
Building materials (1920=100)
Iron and Steel (1920=100)
Per Cent
0 20 40 60 80 100 120 140 160 180
1925 1924 1925 1924 1925 1924 1925 1924 1925 1924 1925 1924

PRODUCTION AND RESERVE STOCKS OF, AND DEMAND FOR, BASIC MATERIALS DURING MONTH OF OCTOBER—U. S. DEPT. OF COMMERCE FIGURES. E. N.-R. CHART

December Contract Letting Substantially Ahead of a Year Ago

Gain Mostly in Building Awards—Other Construction Shows Indications of Recession

FROM present indications, the money value of December construction will exceed that of the corresponding month last year, by about 45 per cent. This is clear gain in actual volume of materials used and work accomplished, since general cost of construction is slightly below a year ago.

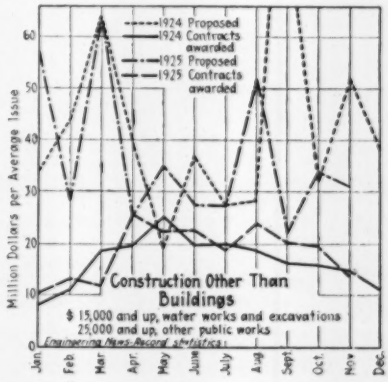

1924 Proposed
1924 Contracts awarded
1925 Proposed
1925 Contracts awarded
Million Dollars per Average Issue
Buildings
$ 150,000 and up for commercial
40,000 and up for industrial
Engineering News-Record statistics
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Judging from the money value of work in the projected stage, as late as Dec. 1, January, 1926 will drop about 6 per cent below the current month. The December gain, however, will consist principally of buildings, since proposed work in construction other than buildings is below a year ago.

Cost of construction will probably advance on Jan. 1, 1926 to a point about 0.2 per cent above the Dec. 1 level. The heavy demand for lumber, brick and other materials in the Florida boom area is the principal cause of the present upward trend in materials costs.

There is no threat of a serious labor disturbance in any of the large cities of the country except New York.

The demand here for a higher schedule for 1926, involves, to a very great extent the adoption of a base rate per hr. that would include the present base pay plus the bonus now being granted.


1924 Proposed
1924 Contracts awarded
1925 Proposed
1925 Contracts awarded
Million Dollars per Average Issue
Construction Other Than Buildings
$ 15,000 and up, water works and excavations
25,000 and up, other public works
Engineering News-Record statistics
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Business Briefs

Call money ranged from 5½ to 6 per cent, Dec. 21; year ago, 4 per cent.

Time loans: sixty-ninety days, 4½@5 per cent; four-six months, 5 per cent.

Commercial paper: best names, 4½ per cent; other names, 4¾ per cent.

On December 1, 1925

E. N.-R. Construction Cost Index Number 205.95

E. N.-R. Construction Volume Index Number 194

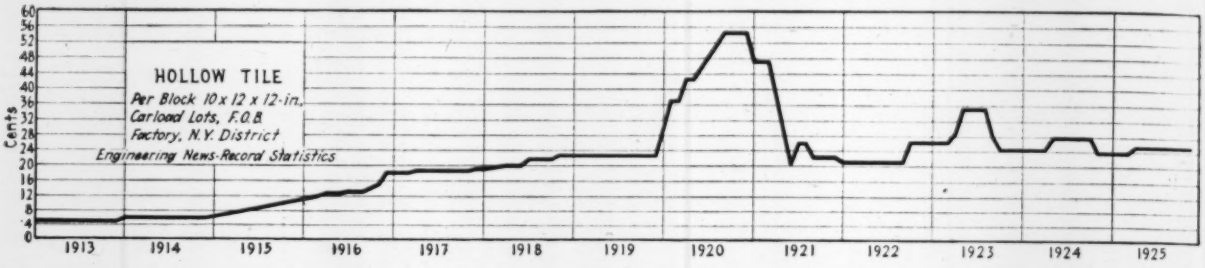
For Explanation and Details of Indexes Since 1913
See the First Issue of Every Month

Weekly Construction Market

THE brisk demand for Southern yellow pine initiated by Florida developments has started a similar movement in the direction of other species of lumber. A telegraphic report to *Engineering News-Record* from Seattle states: "West Coast lumber mills sold more lumber last week than during any other similar period this year—Movement exceeding former margins by 26 per cent—Prices are upward."

Continuation of the gradual upward trend in steel demand, evident during the past four months, is practically assured by present activity in railroad buying. Demand throughout the current year has been consistently heavier, month for month, than during 19[illegible].

Recent developments in railroad purchasing include an order for 5,000 new refrigerator cars at an approximate cost of $16,000,000, for the Pacific Fruit Express Co., an auxiliary of the Union Pacific R.R. Co. These cars are to be delivered to the railroad company from time to time, during the next nine months. The Seaboard Air Line Ry. is in the market for forty Mikado and ten mountain type locomotives, while the Atlantic Coast Line Ry. will require 295 freight cars and seventy-two passenger coaches, according to reports received by *Engineering News-Record.*



	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products									
Structural shapes, 100 lb.	$3.34	—$3.40	$4.15	$3.10	$3.35	$3.07½	$3.30	3.35	$3.75
Structural rivets, 100 lb.	4.50	—3.50	4.75	3.50	3.75	4.65	5.00	3.75	5.50
Reinforcing bars, ¾ in. up, 100 lb.	3.24	—3.30	3.38	3.00	3.25	3.77½	3.35	3.25	2.30
Steel pipe, black, 2½ to 6 in. lap, discount	48%	—57%	53.6%	51%	54.25%	36%	39.2@51%	45%	59.49
Cast-iron pipe, 6 in. and over, ton	+51.60@52.60	—45.00	54.00	50.20@51.20	53.00	64.00	53.00	55.00	55.00
Concreting Material									
Cement without bags, bbl.	2.50@2.70	2.25	2.05	2.10	2.32	2.84	2.31	2.65	1.80
Gravel, ¾ in., cu.yd.	1.75	2.20	2.38	2.00@2.20	1.65	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.00	1.65	2.00	2.25	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.20	2.83	2.00@2.20	1.75	2.50	2.15	3.00	1.50
Miscellaneous									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	62.00	34.00	—56.00	57.00	36.75	+49.50	27.00	25.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl	2.25@2.75	1.30	1.85	1.30	1.35	2.70	1.60	2.80	10.00
Common brick, delivered, 1,000	17.50@19.50	10.50	11.10	12.00	13.50	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.0893	.10	.075	.....	.075	.....	.10	.12
Hollow partition tile 4x12x12, per block	.1112	.0893	.10	.075	.07	.075	.108	.10	.10
Linseed oil, raw, 5 bbl. lots, gal.	.99	1.07	1.13	1.02	—1.08	—1.21	1.10	1.12	1.14
Common Labor									
Common labor, union, hour	.62½@.75	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.82½	.45@.55	.35@.50	.50	.50	.20@.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net and hydrated lime, f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers, 75c.; excavating laborers, 62½c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job; pine is 4-in. instead of 3-in.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.60 for Sheboygan. Common labor not organized.

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of December 3, the next on January 7.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Stone and tile are delivered; sand, gravel, lime and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.93). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3½-in., $59.49.